TOMS RIVER REGIONAL SCHOOLS
Share the Vision!

Content Area: Technology

Course Title: Technology	Grade Level: 8

Unit Plan 1 Planning, Measurement, Safety and The Engineering and Design Process	Pacing Guide 5 Days
Unit Plan 2 Skills exploration	Pacing Guide 10 Days
Unit Plan 3 2D Exploration	Pacing Guide 15-20 Days
Unit Plan 4 3D Exploration	Pacing Guide 15-20 Days

Original Adoption: April 16, 2015
Revisions: Summer 2022
Board Approved: August 17, 2022

Unit 1 Overview
Content Area: Technology
Unit Title: Planning, Measurement, Safety and Engineering and Design Process
Target Course/Grade Level: 8
Pacing Guide: 5 days
Unit Summary: This is a broad introduction to the engineering and design process, the maker mindset, as well as specific instruction on both digital and manual measurement.

Primary Interdisciplinary Connections:

English Language Arts Standards » Writing » Grade 8

W.8.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

English Language Arts Standards » **Speaking & Listening** » **Grade 8**

SL.8.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.

SL.8.4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

English Language Arts Standards » **Language** » **Grade 8**

L.8.1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

NJSLS.ELA-LITERACY.RST.6-8.3

Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Science Standards Grade 8

MS-ETS1-1 Engineering Design
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Engineering Design
Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Engineering Design
Analyze data from tests to determine similarities and differences among several design solutions to

identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4 Engineering Design
Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Math Standards Grade 8
Understand congruence and similarity using physical models, transparencies, or geometry software.
NJSLS.MATH.CONTENT.8.G.A.1

Verify experimentally the properties of rotations, reflections, and translations:

NJSLS.MATH.CONTENT.8.G.A.1.A

Lines are taken to lines, and line segments to line segments of the same length.

NJSLS.MATH.CONTENT.8.G.A.1.B

Angles are taken to angles of the same measure.

NJSLS.MATH.CONTENT.8.G.A.1.C

Parallel lines are taken to parallel lines.

Companion Standards:
Anchor Standards for Reading

NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

Progress Indicators Reading Science and Technical Subjects
RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Anchor Standards for Writing

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

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.

Progress Indicators for Writing History, Science, and Technical Subjects

WHST.6-8.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
A. Introduce a topic and organize ideas, concepts, and information using text structures (e.g. definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g. headings, graphics, and multimedia) when useful to aiding comprehension.
B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
D. Use precise language and domain-specific vocabulary to inform about or explain the topic.
E. Establish and maintain a formal/academic style, approach, and form.
F. Provide a concluding statement or section that follows from and supports the information or explanation presented.

WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

WHST.6-8.7. 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.

WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

21st Century Themes:
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
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.

Learning Targets

Technology Standards:
8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
C. Design: *The design process is a systematic approach to solving problems.*
D. Abilities for a Technological World: *The designed world is the product of a design process that provides the means to convert resources into products and systems.*

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.C.8	Develop a proposal for a chosen solution that includes models (physical, graphical or mathematical) to communicate the solution to peers.
8.2.8.C.2	Explain the need for optimization in a design process.
8.2.8.C.3	Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.

8.2.8.D.1	Design and create a product that addresses a real world problem using a design process under specific constraints.
8.2.8.D.5	Explain the impact of resource selection and the production process in the development of a common or technological product or system.

Unit Essential Questions	Unit Enduring Understandings *Students will understand that…*
Why is measurement important? How and why do we plan? Is failure acceptable? How can the steps in the engineering and design process through the maker lense be used to solve a problem?	● planning contributes to the efficiency of design. ● a good plan or design can result in quality products. ● there is an evolving variety of tools available. ● The engineering and design process is an ongoing process, that includes failure, and is used to solve problems and optimize solutions.
Unit Objectives *Students will know…*	Unit Objectives *Students will be able to…*
● how to work within given constraints such as time, money and materials. ● the importance of having a budget and what goes into it. ● the importance of measuring and measurements. ● The steps in the engineering and design process.	● explain and demonstrate reverse engineering. ● work as part of an effective member of a team. ● identify and follow all safety rules of the room, but not limited to general procedures and equipment use. ● Develop a proposal and communicate the solution to peers.

Evidence of Learning	
Formative Assessments: ● Pretest/Post test ● Observation ● Class Participation ● Think-Pair-Share Summative Assessments: ● Quiz ● Unit Projects	Alternative Assessments: ● Do-Now ● Exit Tickets ● Classroom Games ● Self-assessment ● Feedback from home form Suggested Benchmark: ● Quarterly Exam
Modifications	
English Language Learners: ● Provide clear and specific directions ● Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing ● Provide class notes ahead of time to allow students to preview material and increase comprehension ● Provide extended time ● Simplify written and verbal instructions	Gifted and Talented: ● Extension activities ● Opportunities for Critical Thinking ● Problem Solving/Design Challenges ● Technology Integration ● Student Choice Activities ● Student Driven Activities ● Group Projects ● Tiered Activities
Special Education: ● Utilize graphic organizers to help provide a purpose for reading and increase comprehension ● Assign peer tutor ● Provide clear and specific directions ● Provide class notes ahead of time to allow students to preview material and increase comprehension ● Provide extended time ● Simplify written and verbal instructions	504: ● Utilize graphic organizers to help provide a purpose for reading and increase comprehension ● Assign peer tutor ● Provide clear and specific directions ● Provide class notes ahead of time to allow students to preview material and increase comprehension ● Provide extended time ● Simplify written and verbal instructions
Students at Risk of School Failure: ● Extended Time ● Flexible Grouping ● Small Group Instruction ● Peer Buddies ● Tiered Activities ● Manipulatives ● Graphic Organizers	 ● Chunking Information ● Scaffolded Questioning ● Modified Assignments ● Preferential Seating ● Visual Cues/Modeling ● Technology Integration ● Assistive Technology

Instructional Materials, Equipment needed, Teacher Resources

Computer
Projector
Powerpoint
Google Slides
Safety Rules Quiz
Overview of the Steps in the Engineering and Design Process
Introductory Design Challenges: Samples from Newsome: Luge, Igloo, Cross the Chasm
Suggested Project: Use the engineering process to and upcycled material to design something.
Instructables
MakerShare
Suggested Lesson - Inclusion
Inclusive Emojis

Teacher Notes:

Unit 2 Overview
Content Area: Technology
Unit Title: Skills Exploration
Target Course/Grade Level: 8
Pacing Guide: 10 days
Unit Summary: Students will gain the skills they need in order to be successful in completing the rest of the design challenges throughout the course.

Primary Interdisciplinary Connections:

English Language Arts Standards » Reading: Informational Text » Grade 8

RI.8.7. Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea.

English Language Arts Standards » Writing » Grade 8

W.8.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

W.8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.

English Language Arts Standards » Speaking & Listening » Grade 8

SL.8.4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

English Language Arts Standards » Language » Grade 8

L.8.1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

L.8.2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

L.8.3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.

NJSLS.ELA-LITERACY.RST.6-8.3

Follow precisely a multistep procedure when carrying out experiments, taking measurements, or

performing technical tasks.

Science Standards Grade 8

MS-ETS1-1 Engineering Design
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Engineering Design
Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Engineering Design
Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4 Engineering Design
Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Math Standards Grade 8

NJSLS.MATH.CONTENT.8.G.A.2
Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

NJSLS.MATH.PRACTICE.MP5 Use appropriate tools strategically

NJSLS.MATH.CONTENT.7.G.B.6
Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

NJSLS.MATH.CONTENT.7.G.A.1
Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

NJSLS.MATH.CONTENT.7.G.A.2
Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangles.

Companion Standards

Anchor Standards for Reading

NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
Progress Indicators Reading Science and Technical Subjects

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Anchor Standards for Writing

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

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.
Progress Indicators for Writing History, Science, and Technical Subjects

WHST.6-8.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
A. Introduce a topic and organize ideas, concepts, and information using text structures (e.g. definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g. headings, graphics, and multimedia) when useful to aiding comprehension.
B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
D. Use precise language and domain-specific vocabulary to inform about or explain the topic.
E. Establish and maintain a formal/academic style, approach, and form.
F. Provide a concluding statement or section that follows from and supports the information or explanation presented.

WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

WHST.6-8.7. 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.

WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms

effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

21st Century Themes:

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
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.
CRP11. Use technology to enhance productivity.

Learning Targets

Technology Standards:

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:

All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

A. The Nature of Technology: Creativity and Innovation *Technology systems impact every aspect of the world in which we live.*

C. Design: *The design process is a systematic approach to solving problems.*

D. Abilities for a Technological World: *The designed world is the product of a design process that provides the means to convert resources into products and systems.*

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.A.2	Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system.
8.2.8.A.3	Investigate a malfunction in any part of a system and identify its impacts.
8.2.8.A.5	Describe how resources such as material, energy, information, time, tools, people, and capital contribute to a technological product or system.
8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.C.5	Explain the interdependence of a subsystem that operates as part of a system. Create a technical sketch of a product with materials and measurements labeled
8.2.8.C.6	Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate and test options to repair the product, presenting the better solution.
8.2.8.C.7	Collaborate with peers and experts in the field to research and develop a product using the design process, data analysis and trends, and maintain a design log with annotated sketches to record the developmental cycle.

8.2.8.C.8	Develop a proposal for a chosen solution that include models (physical, graphical or mathematical) to communicate the solution to peers.
8.2.8.D.1	Design and create a product that addresses a real world problem using a design process under specific constraints.

Unit Essential Questions What tools are available for use in the engineering and design process? How can these tools be used to optimize the design process?	Unit Enduring Understandings *Students will understand that…* ● There are many different tools to solve a problem. ● Using the right tool for the job can optimize the design process. ● It is important to document progress in order to properly share and/or evaluate work.
Unit Objectives *Students will know…* ● how to choose the correct tool to complete the task. ● how basic electrical circuits work. ● how to join parts together properly for a functional and aesthetically pleasing project ● how to sketch an idea on paper to express their idea. ● how to draw in 2D on paper and software programs. ● how to draw in 3D using computer software. ● how to document their progress	Unit Objectives *Students will be able to…* ● Use teamwork and collaboration skills when comparing tools and choosing the best one for a task ● Incorporate a basic circuit into a product. ● Use the brainstorming process to come up with many possible designs. ● Collaborate to decide on the best design to build. ● Make a technical 2D drawing that includes measurements. ● Use various CAD programs to create 3D designs. ● Use digital tools to document and share their work.

Evidence of Learning	
Formative Assessments: ● Pretest/Post test ● Observation ● Class Participation ● Think-Pair-Share Summative Assessments: ● Quiz ● Unit Projects	Alternative Assessments: ● Do-Now ● Exit Tickets ● Classroom Games ● Self-assessment ● Feedback from home form Suggested Benchmark: ● Quarterly Exam
Modifications	
English Language Learners: ● Provide clear and specific directions ● Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing ● Provide class notes ahead of time to allow students to preview material and increase comprehension ● Provide extended time ● Simplify written and verbal instructions	Gifted and Talented: ● Extension activities ● Opportunities for Critical Thinking ● Problem Solving/Design Challenges ● Technology Integration ● Student Choice Activities ● Student Driven Activities ● Group Projects ● Tiered Activities
Special Education: ● Utilize graphic organizers to help provide a purpose for reading and increase comprehension ● Assign peer tutor ● Provide clear and specific directions ● Provide class notes ahead of time to allow students to preview material and increase comprehension ● Provide extended time ● Simplify written and verbal instructions	504: ● Utilize graphic organizers to help provide a purpose for reading and increase comprehension ● Assign peer tutor ● Provide clear and specific directions ● Provide class notes ahead of time to allow students to preview material and increase comprehension ● Provide extended time ● Simplify written and verbal instructions
Students at Risk of School Failure: ● Extended Time ● Flexible Grouping ● Small Group Instruction ● Peer Buddies ● Tiered Activities ● Manipulatives ● Graphic Organizers	 ● Chunking Information ● Scaffolded Questioning ● Modified Assignments ● Preferential Seating ● Visual Cues/Modeling ● Technology Integration ● Assistive Technology

Instructional Materials, Equipment needed, Teacher Resources

Computers for digital measurement
Rulers for physical measurement (rulers, protractors), ruler practice worksheets
CAD software such as Google Sketchup Pro, Tinkercad, AutoCad
Software and updates specific to CNC, laser cutting equipment and vinyl equipment such as Adobe Illustrator, Photoshop
Online programs or apps such as YouiDraw, Scratch programming
Basic circuitry materials: Arduino, Makey Makey, Micro:Bit, LEDs, batteries, copper tape, etc.
Snap Circuits and Intro to Circuits Packet - Newsome
Circuit and Motor Vocabulary - Newsome
Makey Makey Task Cards - Newsome
Inclusive Technologies

Teacher Notes:

Unit 3 Overview
Content Area: Technology
Unit Title: 2D Exploration
Target Course/Grade Level: 8
Pacing Guide: 15-20 days
Unit Summary: The students will be able to use a 2D technical drawing to create a 3D finished product using hand tools.

Primary Interdisciplinary Connections:
English Language Arts Standards » Writing » Grade 8

W.8.1. Write arguments to support claims with clear reasons and relevant evidence.

W.8.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

W.8.5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

English Language Arts Standards » Writing » Grade 8

W.8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.

English Language Arts Standards » Speaking & Listening » Grade 8

SL.8.4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

SL.8.5. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

English Language Arts Standards » Language » Grade 8

L.8.1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

L.8.2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

L.8.3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.

Science Standards Grade 8

MS-ETS1-1 Engineering Design
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful

solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Engineering Design
Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Engineering Design
Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4 Engineering Design
Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Math Standards Grade 8

NJSLS.MATH.CONTENT.8.EE.B.5
Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

Companion Standards

Anchor Standards for Reading

NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

Progress Indicators Reading Science and Technical Subjects
RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Anchor Standards for Writing

NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

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.

Progress Indicators for Writing History, Science, and Technical Subjects

WHST.6-8.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
A. Introduce a topic and organize ideas, concepts, and information using text structures (e.g. definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g. headings, graphics, and multimedia) when useful to aiding comprehension.
B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
D. Use precise language and domain-specific vocabulary to inform about or explain the topic.
E. Establish and maintain a formal/academic style, approach, and form.
F. Provide a concluding statement or section that follows from and supports the information or explanation presented.

WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

WHST.6-8.7. 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.

WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Learning Targets

Technology Standards:
8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:
All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
A. The Nature of Technology: Creativity and Innovation *Technology systems impact every aspect of the world in which we live.*
C. Design: *The design process is a systematic approach to solving problems.*
D. Abilities for a Technological World: *The designed world is the product of a design process that provides the means to convert resources into products and systems.*

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.A.2	Examine a system, consider how each part relates to other parts, and discuss a part to

	redesign to improve the system.
8.2.8.A.3	Investigate a malfunction in any part of a system and identify its impacts.
8.2.8.A.5	Describe how resources such as material, energy, information, time, tools, people, and capital contribute to a technological product or system.

8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
8.2.8.C.2	Explain the need for optimization in a design process.
8.2.8.C.3	Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.C.5	Explain the interdependence of a subsystem that operates as part of a system. Create a technical sketch of a product with materials and measurements labeled
8.2.8.C.6	Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate and test options to repair the product, presenting the better solution.
8.2.8.C.7	Collaborate with peers and experts in the field to research and develop a product using the design process, data analysis and trends, and maintain a design log with annotated sketches to record the developmental cycle.
8.2.8.C.8	Develop a proposal for a chosen solution that include models (physical, graphical or mathematical) to communicate the solution to peers.
8.2.8.D.1	Design and create a product that addresses a real world problem using a design process under specific constraints.
8.2.8.D.2	Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook.
8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.
8.2.8.D.5	Explain the impact of resource selection and the production process in the development of a common or technological product or system.
8.2.8.D.6	Identify and explain how the resources and processes used in the production of a current technological product can be modified to have a more positive impact on the environment.

Unit Essential Questions	Unit Enduring Understandings *Students will understand that…*
How can you use a 2D drawing to create a prototype? How do the parts of a design influence the function of the system as a whole?	● creating an accurate technical drawing facilitates building.. ● The ideas they draw on paper can be used to create a 3D prototype. ● Each part of a design functions to make up a system.
Unit Objectives *Students will know…* ● How to apply measurement skills in the creation of an accurate 2D technical	Unit Objectives *Students will be able to…* ● Follow their 2D plan to create a 3D prototype using hand tools.

drawing. ● How to use a 2D drawing and skills in using hand tools to create a 3D prototype. ● The importance of creating an accurate 2D drawing.	● Understand how to create a budget and design within the constraints of time, money and materials. ● Examine the parts of a system, and identify one part of the system that can be improved upon to improve the way the system functions.

Evidence of Learning	
Formative Assessments: ● Pretest/Post test ● Observation ● Class Participation ● Think-Pair-Share Summative Assessments: ● Quiz ● Unit Projects	Alternative Assessments: ● Do-Now ● Exit Tickets ● Classroom Games ● Self-assessment ● Feedback from home form Suggested Benchmark: ● Quarterly Exam
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Instructional Materials, Equipment needed, Teacher Resources

Sample Challenges:

- **CO2 Dragsters**
  - Balsa/basswood vehicle blanks, cutters, glue, wax paper and 11X17 paper, co2 cartridges, wheels, axles, race track, paint, coping saws, files, sandpaper,
- **Scribble Bots**
  - DC motors, batteries, wire, markers, various craft materials
- **Structures**
  - Bass modeling wood, modeling glue, wax paper, sandpaper, structure tester, computer for result analysis

Teacher Notes:

Dave Letterman Will it Float (Be sure to preview if sharing with students)

Unit 4 Overview
Content Area: Technology
Unit Title: 3D Exploration
Target Course/Grade Level: 8
Pacing Guide: 15-20 days
Unit Summary: The students will use digital tools to optimize the engineering and design process.

Primary Interdisciplinary Connections:

English Language Arts Standards » Reading: Informational Text » Grade 8

RI.8.7. Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea.

English Language Arts Standards » Writing » Grade 8

W.8.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

W.8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.

W.8.7. 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.

W.8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

English Language Arts Standards » Speaking & Listening » Grade 8

SL.8.4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

SL.8.5. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

English Language Arts Standards » Language » Grade 8

L.8.1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

L.8.2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

L.8.3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.

English Language Arts Standards » Speaking & Listening » Grade 8

SL.8.5. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

Science Standards Grade 8
MS-ETS1-1 Engineering Design
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Engineering Design
Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Engineering Design
Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4 Engineering Design
Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and the speed of an object.

MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Math Standards Grade 8:
NJSLS.MATH.CONTENT.HSG.GMD.B.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.

NJSLS.MATH.CONTENT.HSG.MG.A.3
Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

NJSLS.MATH.CONTENT.HSG.MG.A.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)

NJSLS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.

Companion Standards

Anchor Standards for Reading

NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

Progress Indicators Reading Science and Technical Subjects
RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Anchor Standards for Writing

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 an understanding of the subject under investigation.

Progress Indicators for Writing History, Science, and Technical Subjects

WHST.6-8.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
A. Introduce a topic and organize ideas, concepts, and information using text structures (e.g. definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g. headings, graphics, and multimedia) when useful to aiding comprehension.
B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
D. Use precise language and domain-specific vocabulary to inform about or explain the topic.
E. Establish and maintain a formal/academic style, approach, and form.
F. Provide a concluding statement or section that follows from and supports the information or explanation presented.

WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

WHST.6-8.7. 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.

WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

21st Century Themes:
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.
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.

Learning Targets

Technology Standards:

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:

All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

A. The Nature of Technology: Creativity and Innovation *Technology systems impact every aspect of the world in which we live.*

C. Design: *The design process is a systematic approach to solving problems.*

D. Abilities for a Technological World: *The designed world is the product of a design process that provides the means to convert resources into products and systems.*

CPI #	Cumulative Progress Indicator (CPI)
8.2.8.A.2	Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system.
8.2.8.A.3	Investigate a malfunction in any part of a system and identify its impacts.
8.2.8.A.5	Describe how resources such as material, energy, information, time, tools, people, and capital contribute to a technological product or system.

8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
8.2.8.C.2	Explain the need for optimization in a design process.
8.2.8.C.3	Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
8.2.8.C.4	Identify the steps in the design process that would be used to solve a designated problem.
8.2.8.C.5	Explain the interdependence of a subsystem that operates as part of a system. Create a technical sketch of a product with materials and measurements labeled.
8.2.8.C.6	Collaborate to examine a malfunctioning system and identify the step-by-step process used to troubleshoot, evaluate and test options to repair the product, presenting the better solution.
8.2.8.C.7	Collaborate with peers and experts in the field to research and develop a product using the

	design process, data analysis and trends, and maintain a design log with annotated sketches to record the developmental cycle.
8.2.8.C.8	Develop a proposal for a chosen solution that include models (physical, graphical or mathematical) to communicate the solution to peers.
8.2.8.D.1	Design and create a product that addresses a real world problem using a design process under specific constraints.
8.2.8.D.2	Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook.
8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.
8.2.8.D.4	Research and publish the steps for using and maintaining a product or system and incorporate diagrams or images throughout to enhance user comprehension.
8.2.8.D.5	Explain the impact of resource selection and the production process in the development of a common or technological product or system.
8.2.8.D.6	Identify and explain how the resources and processes used in the production of a current technological product can be modified to have a more positive impact on the environment.

Unit Essential Questions How can digital tools be used to design, create, evaluate, and redesign 3D prototype? How can 3D prototypes lead to solutions to real world problems?	Unit Enduring Understandings *Students will understand that…* ● The engineering and design process is still used in creating a prototype even when using digital tools to create a 3D design. ● Prototypes can be used to test solutions to real world problems. ● Optimizing both the form and function of a design are important.
Unit Objectives *Students will know…* ● How to apply skills in online programs to the design of a 3D product. ● How to create a 3D drawing so others can read it. ● The significance of sharing or publishing work with others for the purpose of contributing to the global community.	Unit Objectives *Students will be able to…* ● Use various CAD programs to make a 3D design. ● Accurately read their 3D design to create a prototype. ● Create an aesthetically pleasing product. ● Improve upon their original design to optimize how it functions. ● Document and share their prototypes with others.

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Instructional Materials, Equipment needed, Teacher Resources

- 3D Printer - Tinkercad
- Lasercutter - Illustrator
- Vinyl Cutter - YouiDraw
- CNC Router - ArtCam
- Space Apps Challenge

Teacher Notes: