

**HILLSBOROUGH TOWNSHIP SCHOOL DISTRICT**

**HILLSBOROUGH TOWNSHIP HIGH SCHOOL**

**STEM CURRICULUM**

**GRADE 7**

**JULY 2014**

## **Seventh Grade STEM Course Overview**

The seventh grade STEM course of study includes an introduction to invention and innovation, as well as a primer for the engineering design process.

In Introduction to Invention and Innovation, students explore the role of technology to solve problems or to help accomplish tasks that could not be accomplished without the help of technology. Students are introduced to the machines and safety protocols used in a technology education classroom. Students gain an understanding that the development of technology is a human activity, is the result of individual or collective needs, and requires the ability to be creative. Students gain an appreciation for how technology influences and affects society, economy, culture, and politics. Students learn first-hand how the invention and innovation process is iterative and strives to meet human needs.

In studying the Engineering Design Process, students investigate how the engineering design practices are used to research, develop, troubleshoot, and experiment to solve problems for invention and innovation. Students learn that technology involves many types of problems and different approaches to solve them, including troubleshooting, research and development, invention and innovation, and experimentation. The engineering design process must take all of these things into account.

The seventh grade STEM curriculum meets the requirements of the New Jersey Core Curriculum Content Standards for Technology Education, the Standards for Technology Literacy, as well as 21<sup>st</sup> Century Skills development.

Unit of Study/ Pacing	Content	NJCCCS Content Statement	NJCCCS cpi	Essential Questions	Enduring Understandings	Learning Targets	Assessment – Formative Summative Common Benchmark	Interdisciplinary Connections
<p><b>Unit 1:</b> Introduction to Invention and Innovation  2-3 days</p>	<p><b>Lesson Block 1:</b> Inventing 101  Knowledge of room, rules, and machines</p>	<p><b>Content:</b> Technology systems impact every aspect of the world in which we live.  <b>Content:</b> The designed world is the product of a design process that provides the means to convert resources into products and systems.</p>	<p><b>8.2.8.A.1</b> Explain the impact of globalization on the development of a technological system over time.  <b>8.2.8.G.2</b> Explain the interdependence of a subsystem that operates as part of a system.</p>	<p>What is Technology Education?</p>	<p>New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.  The development of technology is a human activity, is the result of individual or collective needs, and requires the ability to be creative.</p>	<p>Explain that new products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.  Explain that the development of technology is a human activity and is the result of individual or collective needs and the ability to be creative.  Explain that technology is closely linked to creativity, which has resulted in innovation.  Define the terms invention and innovation.  Students will complete an activity such as: Read one of the four vignettes from “Great Thinkers and Their Inventions” or experience a lesson or video about inventors and their inventions, and identify the need or desire satisfied by the inventors.</p>	<p>Pre-test  <b>Common Benchmark:</b> Summative Multiple Choice (used as pre-test and post-test)</p>	<p><b>Technology: Standards for Technological Literacy (STL) (ITEEA, 2000/2002/2007)</b> Understanding the characteristics and scope of technology (STL-1) Understanding the Core Concepts of Technology (STL-2) Understanding the relationships among technologies and connections with other fields of study (STL-3) Understanding the cultural, social, economic, and political effects of technology (STL-4) Understanding the effects of technology on the environment (STL-5) Understanding the role of society in the development and use of technology (STL-6) Understanding the influence of technology on history (STL-7) Understanding the attributes of design (STL-8)</p>

						Work safely and accurately with a variety of tools, machines, and materials.		
				What are the rules and expectations of the STEM course?	Understand the basic expectations of rules for the course.		Accurately verbalize at least the most important and (safety) rules and expectations.	
<p><b>Unit 2</b></p> <p><b>Introduction to the invention process.</b></p> <p>2 -4 days</p>	<p>What's Your Problem?</p>	<p><b>Content:</b> The use of technology and digital tools requires knowledge and appropriate use of operations and related applications.</p> <p><b>Content:</b> Technological advancements create societal concerns regarding the practice of safe, legal, and ethical behaviors.</p>	<p><b>8.1.8.A.5</b> Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.</p> <p><b>8.1.8.D.3</b> Demonstrate how information may be biased on a controversial issue.</p> <p><b>8.2.8.A.1</b> Explain the impact of</p>	<p>How does technology help to solve problems?</p> <p>How does technology influence and affect society, economy, culture, and politics?</p>	<p>Technologies are not always perfect and the impacts of technologies can be positive or negative, intended or unintended.</p> <p>Societal expectations, economy, and politics impact the innovation and invention process.</p> <p>2</p>	<p>Define and explain the role that technology, society, and politics play in the invention or innovation process.</p> <p>Do an activity such as: Students act as Invention Detectives to reveal unintended effects of previously developed technologies.</p> <p>Explain how societal expectations impact the acceptance and use of products and systems.</p> <p>Apply the ideas presented in a discussion about the impacts of technologies on humans and society to by-products of modern technology.</p> <p>Identify, explain, and discuss the history of</p>	<p>Constructed response questions</p> <p>Teacher leads a group discussion such as: Debate on controversial technologies in the news within the past 5 years</p>	<p><b>Technology: Standards for Technological Literacy (STL) (ITEEA, 2000/2002/2007)</b> New products and systems can be developed to solve problems or to help to do things that could not be done without the help of technology. (STL-1F) The development of technology is a human activity and is the result of individual or collective needs and the ability to be creative. (STL-1G) Technology is closely linked to creativity, which has resulted in innovation. (STL-1H) Trade-off is a decision process recognizing the need for careful compromises among competing factors. (STL-2S) A product, system, or environment developed for one setting may be applied to another setting. (STL-3E)</p>

		<p><b>Content:</b> Technology systems impact every aspect of the world in which we live.</p>	<p>globalization on the development of a technological system over time.</p> <p><b>8.2.8.C.2</b> Compare and contrast current and past incidences of ethical and unethical use of labor in the United States or another country and present results in a media rich presentation.</p> <p><b>8.2.8.D.1</b> Evaluate the role of ethics and bias on trend analysis and prediction in the development of a product that impacts communities in the United States and/or other countries.</p> <p><b>8.2.8.F.2</b> 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 (e.g., by using</p>			<p>various inventions and innovations.</p> <p>Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task.</p> <p>Identify famous inventors and their inventions.</p>	<p>Organize and present research findings effectively.</p> <p>Organize and present research findings effectively.</p>	<p>The development and use of technology poses ethical questions. (STL-4F) Economic, political, and cultural issues are influenced by the development and use of technology. (STL-4G) Decisions to develop and use technologies often put environments and economic concerns in direct competition with one another. (STL-5F) Throughout history, new technologies have resulted from the demands, values, and interests of individuals, industries, and societies. (STL-6D) The use of inventions and innovations has led to changes in society and the creation of new needs and wants (STL-6E) Social and cultural priorities and values are reflected in technological devices. (STL-6F) Meeting societal expectations is the driving force behind the acceptance and the use of products and systems. (STL-6G) Many inventions and innovations have evolved by using slow and methodical processes of tests and refinements. (STL-7C) The specialization of function has been at the heart of many technological improvements. (STL-7D) In the past, an invention or innovation was not usually developed with the knowledge of science. (STL-7F) Design is a creative planning process that leads to useful products and systems. (STL-8E)</p> <p><b>Science</b></p>
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<p><b>Unit 3 Introduction to the creation processes</b> 7-10 days</p>	<p>Using tools to create a simple product, utilizing available tools.</p>	<p><b>Content:</b> Effective use of digital tools assists in gathering and managing information.</p> <p><b>Content:</b> The designed world is the product of a design process that provides the means to convert resources into products and systems.</p>	<p><b>8.1.8.A.5</b> Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.</p> <p><b>8.2.8.G.2</b> Explain the interdependence of a subsystem that operates as part of a system.</p>	<p>How to safely and effectively use the available tools to perform processes facilitating the desired result</p> <p>What is a 'system'?</p>	<p>The importance of safety when using tools, following directions and how to use the tools for a given process.</p> <p>Understand that components comprise a whole.</p>	<p>Demonstrate the safe and effective use of tools by performing prescribed processes.</p> <p>Be able to describe how systems' components all combine to make an effective product. For example, describe how the various components of the bandsaw add up to an effective machine which is useless without one of its major subsystems (blade,</p>	<p>Adequate production of desired product. Such as a simple bent plastic stand or other multi-material product.</p> <p>Students are using the correct setup when using a machine/tool</p>	<p><b>Technology: Standards for Technological Literacy (STL) (ITEEA, 2000/2002/2007)</b> Design Understanding the Attributes of Design (STL-8) Design is a creative planning process that leads to useful products and systems. (STL-8E) There is no perfect design. (STL-8F) Requirements for a design are made up of criteria and constraints. (STL-8G) Understanding engineering design (STL-9) Design involves a set of steps, which can be performed in different sequences and repeated as needed. (STL-9F)</p> <p><b>Math</b> <b>7.RP.1</b> Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks 1/2 mile in each 1/4 hour,</p>

						guides, motor, pulleys, stand, nuts and bolts).		<p>compute the unit rate as the complex fraction <math>\frac{1}{2} / \frac{1}{4}</math> miles per hour, equivalently 2 miles per hour.</p> <p><b>7.NS.1.d</b> Apply properties of operations as strategies to add and subtract rational numbers.</p> <p><b>7.NS.2.c</b> Apply properties of operations as strategies to multiply and divide rational numbers.</p> <p><b>7.EE.3</b> 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.</p> <p>Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional <math>\frac{1}{10}</math> of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar <math>9\frac{3}{4}</math> inches long in the center of a door that is <math>27\frac{1}{2}</math> inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.</p> <p><b>7.G.1</b> 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.</p>
<b>Unit 4</b>	Identify the problem.	<b>Content:</b> The use of technology and digital tools requires	<b>8.1.8.A.1</b> Create professional documents (e.g.,	How does the engineering design process drive	The invention and innovation process is iterative as it strives to meet human needs.	Explain that new products and systems can be developed to solve problems or to help do things that could not be	Constructed response questions  Performance rubrics	<b>Technology: Standards for Technological Literacy (STL) (ITEEA, 2000/2002/2007)</b> The Nature of Technology

<p><b>Application of the Engineering Design process and introduction to the design loop.</b></p> <p>19-25 days</p>	<p>Research solution</p> <p>Generating a Solution</p> <p>Build your product</p> <p>Test your product</p> <p>Re-evaluate your product and identify any new problems. (modify)</p>	<p>knowledge and appropriate use of operations and related applications.</p> <p><b>Content:</b> Effective use of digital tools assists in gathering and managing information.</p> <p><b>Content:</b> The design process is a systematic approach to</p>	<p>newsletter, personalized learning plan, business letter or flyer) using advanced features of a word processing program.</p> <p><b>8.1.8.A.5</b> Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.</p> <p><b>8.1.8.E.1</b> Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.</p> <p><b>8.2.8.B.1</b> Design and create a product that addresses a real-world problem using the design process and working with specific criteria and constraints.</p> <p><b>8.2.8.B.3</b> Solve a science-based design</p>	<p>invention and innovation?</p>	<p>The development of technology is a human activity and is the result of individual or collective needs to solve problems.</p> <p>The development of technology requires the ability to be creative and can pose ethical dilemmas, as well as impact society.</p> <p>Explain that design involves a set of steps that can be performed in different sequences and repeated when needed.</p>	<p>done without the help of technology.</p> <p>Explain that the development of technology is a human activity and is the result of individual or collective needs and the ability to be creative.</p> <p>Explain that the development and use of technology poses ethical questions.</p> <p>Explain that economic, political, and cultural issues are influenced by the development and use of technology.</p> <p>Explain that decisions to develop and use technologies often put environments and economic concerns in direct competition with one another.</p> <p>Explain that there is no perfect design.</p> <p>Define requirements of a design as criteria and constraints.</p> <p>Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task.</p>	<p><b>Common Benchmark:</b> Portfolio</p>	<p>Understanding the characteristics and scope of technology (STL-1) New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. (STL-1F) The development of technology is a human activity and is the result of individual or collective needs and the ability to be creative. (STL-1G) Technology and Society Understanding the cultural, social, economic, and political effects of technology (STL-4) The development and use of technology poses ethical questions. (STL-4F) Economic, political, and cultural issues are influenced by the development and use of technology. (STL-4G) Understanding the effects of technology on the environment (STL-5) Decisions to develop and use technologies often put environments and economic concerns in direct competition with one another (STL-5F) Design Understanding the Attributes of Design (STL-8) Design is a creative planning process that leads to useful products and systems. (STL-8E) There is no perfect design. (STL-8F) Requirements for a design are made up of criteria and constraints. (STL-8G)</p> <p><b>Science</b> <b>Content:</b> Science involves practicing productive social interactions with peers, such</p>
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		<p>solving problems.</p>	<p>challenge and build a prototype using science and math principles throughout the design process.</p> <p><b>8.1.8.E.1</b> Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.</p> <p><b>8.2.8.F.1</b> Explain the impact of resource selection and processing in the development of a common technological product or system.</p>	<p>What is your design problem?</p> <p>What does your research show?</p> <p>What is your Solution?</p> <p>Did you build your product? Did you test your product?</p> <p>Re-evaluate your product</p>	<p>Understand how the utilizing the Engineering Design Loop Process produces a product that meets the needs of the problem.</p> <p>Explain that requirements for a design are made up of criteria and constraints.</p>	<p>Define your design problem.</p> <p>Use research to refine your understanding of the problem.</p> <p>Brainstorm your solution and develop a design.</p> <p>Create product.</p> <p>Understand that there is no perfect design and find the flaws.</p>	<p>Have they identified their problem?</p> <p>Are they able to conduct research that effectively shows the scope of existing solutions?</p> <p>Show proof of Brainstorming.</p> <p>Evaluate product for quality of construction.</p>	<p>as partner talk, whole-group discussions, and small-group work.</p> <p><b>5.1.8.D.1:</b> Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.</p> <p><b>Content:</b> Forces have magnitude and direction. Forces can be added. The net force on an object is the sum of all the forces acting on the object. An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force.</p> <p><b>5.2.8.E.2:</b> Compare the motion of an object acted on by balanced forces with the motion of an object acted on by unbalanced forces in a given specific scenario.</p> <p><b>Math</b></p> <p><b>7.RP.1</b> Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.</p> <p><b>7.NS.1.d</b> Apply properties of operations as strategies to add and subtract rational numbers.</p> <p><b>7.NS.2.c</b> Apply properties of operations as strategies to multiply and divide rational numbers.</p> <p><b>7.EE.3</b> Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers</p>
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		<p><b>Content:</b> Technology is created through the application and appropriate use of technological resources.</p>		and identify any new problems. (modify)			<p>Show proof of proposed modifications (if any) to your product.</p> <p>Identify and describe the major steps in the engineering design process.</p>	<p>in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar <math>9\frac{3}{4}</math> inches long in the center of a door that is <math>27\frac{1}{2}</math> inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.</p> <p><b>7.G.1</b> 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.</p> <p><b>7.G.6</b> 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.</p>
<p><b>Unit 5- Closure 3 days</b></p>	<p>Grading, cleaning and Post-testing</p>	<p><b>Content:</b> The design process is a systematic approach to solving problems.</p>	<p><b>8.2.8.B.1</b> Design and create a product that addresses a real-world problem using the design process and working with specific criteria and constraints</p>	<p>How well does your product meet the requirements of the rubric?</p>	<p>Organization, documentation, and presentation of a product and it's creation by the Engineering Design Loop is an essential component of the creation process.</p> <p>The crucial step of invention and innovation is documentation, which .</p>	<p>Presentation of and potential 'sale' of a product is a crucial step of a successful product.</p>	<p>Project performance rubrics</p> <p>Portfolio Rubric</p> <p>Summative post test.</p>	<p><b>Technology: Standards for Technological Literacy (STL) (ITEEA, 2000/2002/2007)</b> Design a product, system or environment for a specific setting (STL-3) Design is a creative planning process that leads to useful products and systems. (STL-8E) There is no perfect design. (STL-8F)</p>

			<p><b>8.2.8.B.2</b> Identify the design constraints and trade offs involved in designing a prototype, (how the prototype might fail, and how it might be improved) by completing a design problem and reporting results in a multimedia presentation.</p> <p><b>8.2.8.B.3</b> Solve a science-based design challenge and build a prototype using science and math principles throughout the design process.</p>	How well does your Portfolio meet the requirements of the rubric?	allows for analysis of creation process and reproduction of similar or identical results.	The portfolio and documentation are useful tools.		<p>Requirements for a design are made up of criteria and constraints. (STL-8G) Understanding engineering design (STL-9) Design involves a set of steps, which can be performed in different sequences and repeated as needed. (STL-9F) Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions. (STL-9H) Abilities to apply the design process (STL-11) Marketing a product involves informing the public about it as well as assisting in selling and distributing it. (STL-19K)</p> <p><b>Math</b> <b>7.NS.1.d</b> Apply properties of operations as strategies to add and subtract rational numbers. <b>7.NS.2.c</b> Apply properties of operations as strategies to multiply and divide rational numbers. <b>7.EE.3</b> 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. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new</p>
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**Seventh Grade STEM  
Bibliography**

Great Thinkers and Their Inventions

*Harley Davidson Birth of the V-Rod* video