

Invention and Innovation – An Overview

Name of Course	Invention and Innovation
Standards Addressed	See Responsibility Matrix for Technology, Mathematics, and Science in Appendix A
Intended Audience	7th Grade students (no prerequisite)
Course Overview	<p><i>Invention and Innovation</i> provides students with opportunities to apply the design process in the invention or innovation of a new product, process, or system. In this course, students will learn all about invention and innovation. They will have opportunities to study the history of inventions and innovations, including their impacts on society. They will learn about the core concepts of technology, and about the various approaches to solving problems, including engineering design and experimentation. Students will apply their creativity in the invention and innovation of new products, processes, or systems. Finally, students learn about how various inventions and innovations impact their lives. Students participate in engineering-design activities to understand how criteria, constraints, and processes affect designs. Students are involved in activities and experiences where they learn about brainstorming, visualizing, modeling, constructing, testing, experimenting, and refining designs. Students also develop skills in researching for information, communicating design information, and reporting results.</p>
Course Length	18 weeks recommended
Connections	<p><i>Invention and Innovation</i> builds on K-5 experiences as well as those in <i>Exploring Technology</i> and develops a student's understanding of the scope of technology and the iterative nature of technological design and problem-solving processes. Likewise, students participate in engineering-design activities to understand how criteria, constraints, and processes affect designs. Students will be involved in activities and experiences where they learn about brainstorming, visualizing, modeling, constructing, testing, experimenting, and refining designs. Students will also develop skills in researching for information, communicating design information, and reporting results.</p> <p><i>Invention and Innovation</i> provides the foundation for future studies in the sequence. Students learn how Technology, Innovation, Design, and Engineering interrelate and are interdependent.</p>

Invention and Innovation Model Course Guide Analysis

Unit 1

UNIT/UNIT OBJECTIVES	LESSON/ LESSON ACTIVITIES	ST DS	BENCHMARKS ADDRESSED	LESSON OBJECTIVES
<p>Introduction to Invention and Innovation</p> <ul style="list-style-type: none"> Define and describe terms and concepts related to invention and innovation. Define and explain the role that technology and society play in invention and innovation. Identify and important invention or innovation from the past and give a presentation on it. Research one artifact related to information and communication technology that is at least twenty years old and report on its origins and impacts. Design and make a simple invention. 	<p>Our First Invention –</p> <ul style="list-style-type: none"> Review terms Crossword puzzle Review engineering design process Students make a jelly bean dispenser Students present invention to class 	1,7,9,10,11	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. (1-F)	Explain that 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
	The development of technology is a human activity and is the result of individual or collective needs and the ability to be creative. (1-G)		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.	
	Technology is closely linked to creativity, which has resulted in innovation. (1-H)		Explain that technology is closely linked to creativity, which has resulted in innovation.	
	The specialization of function has been at the heart of many technological improvements. (7-D)		Explain that innovation often involves decreasing the overall capabilities of a product or system in order to increase its ability to perform a more narrow or specific task very efficiently.	
	Design involves a set of steps that can be performed in different sequences and repeated when needed. (9-F)		Explain that design involves a set of steps that can be performed in different sequences and repeated when needed.	
	Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying and existing product or system to improve it. (10-G)		Define the terms invention and innovation.	
	Apply a design process to solve problems in and beyond the laboratory-classroom. (11-H)		Design and make a simple invention.	
			Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task. Work safely and accurately with a variety of tools, machines, and materials.	
	<p>The Most Important Invention or Innovation of Our Time</p> <ul style="list-style-type: none"> Small group discussion and reporting to class on worksheet provided Research and report activity Inventors Card Game 	6,7,12	Throughout history, new technologies have resulted from the demands, values, and interests of individuals, industries, and societies. (6-D)	Define and explain the role that technology and society play in invention and innovation process.
	Meeting societal expectations is a driving force behind the acceptance and use of products and systems. (6-G)		Explain how societal expectations impact the acceptance and use of products and systems.	
	Many inventions and innovations have evolved by using slow methodical processes of tests and refinements. (7-C)		Identify, explain, and discuss the history of various inventions and innovations.	
	Use computers and calculators in order to achieve a given purpose. (12-J)		Organize and present research findings effectively.	
			Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task. Identify famous inventors and their inventions.	
	<p>Exploring the History of Information and Communication Technology Objects, Processes, and Systems</p> <ul style="list-style-type: none"> Lecture Research and report on a selected information and communication technology 	7,17	In the past, an invention or innovation was not usually developed with the knowledge of science. (7-F)	Explain why, in the past, an invention or innovation was not usually developed with the knowledge of science.
	Information and communication systems allow information to be transferred from human to human, human to machine, and machine to human. (17-H)		Research and report on a selected information and communication technology.	
The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas. (17-K)	Explain that the use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.			

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Unit 2

UNIT/UNIT OBJECTIVES	LESSON/ LESSON ACTIVITIES	STDS	BENCHMARKS ADDRESSED	LESSON OBJECTIVES	
<p>Core Concepts of Technology</p> <ul style="list-style-type: none"> For each category of the designed world, identify one or two major innovations or inventions. Build a simple mechanical device. Describe its relation to the systems model and identify its common technological systems. Disassemble a consumer product and discuss how its various components and systems relate to the core concepts of technology. Identify various systems found in a transportation vehicle or constructed building. 	<p>Inventions and Innovations in the Designed World</p> <ul style="list-style-type: none"> Review major categories of the designed world Students complete worksheet Discussion of results 	2,3,4,6	Technology systems can be connected to one another. (2-P)	Explain that technology systems can be connected to one another.	
			Requirements are the parameters placed on the development of a product or system. (2-R)	Explain that requirements are the parameters placed on the development of a product or system.	
			Different technologies involve different sets of processes. (2-T)	Explain that different technologies involve different sets of processes.	
			A product, system, or environment developed for one setting may be applied to another setting. (3-E)	Explain and provide examples of a product, system, or environment developed for one setting may be applied to another setting.	
			Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. (4-D)	Explain that technology, by itself, is neither good or bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.	
			The use of inventions and innovations has lead to changes in society and the creation of new needs and wants. (6-E)	Explain and provide examples of inventions and innovations that have lead to changes in society and the creation of new needs and wants.	
		Identify the major categories of the designed world.			Identify selected inventions and innovations and their relationships to the designed world.
	<p>Product Disassembly</p> <ul style="list-style-type: none"> View “Smarthome” Internet Site Identify systems in a structure (school, home) Product disassembly. 	2,3,12	Technology systems include input, process, output and, at times, feedback (2-M)	Identify and describe a system and its input, process, output, and feedback.	
			An open-loop system has no feedback path and requires human intervention; whole a closed-loop system uses feedback. (2-O)	Explain the difference between an open-loop and a closed-loop system.	
			Controls are mechanisms or particular steps that people perform to using information about the system that causes systems to change. (2-V)	Explain that controls are mechanisms or particular steps that people perform to using information about the system that causes systems to change.	
			Technology systems often interact with one another (3-D)	Identify common types of “systems” (e.g. mechanical, electrical, etc.) found in technological products.	
			Use information provided to manuals, protocols, or by experienced people to see and understand how things work. (12-H)	Disassemble a consumer product and discuss how its various components and systems relate to the core concepts of technology.	
			Use tools, materials, and machines safely to diagnose, adjust, and repair systems. (12-I)	Disassemble a common product and identify the common systems and subsystems found inside.	
	<p>Ding Dong - A Doorbell System!</p> <ul style="list-style-type: none"> Review core concept terms (systems, resources, requirements, optimization, trade-off, processes, and control.) Lecture/demo electricity basics Assemble a doorbell circuit 	2,12	Systems thinking involves considering how every part relates to another. (2-N)	Explain that systems thinking involves considering how every part relates to another.	
			Trade-off is a decision process recognizing the need for compromises in complex, real-life situations. (2-S)	Define the terms system, resources, requirements, optimization, tradeoff, processes, and control.	
			Use tools, materials, and machines safely to diagnose, adjust, and repair systems. (12-I)	Build a simple doorbell system.	
				Identify various systems found in a transportation vehicle or constructed building.	

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Unit 3

UNIT/UNIT OBJECTIVES	LESSON/ LESSON ACTIVITIES	STDS	BENCHMARKS ADDRESSED	LESSON OBJECTIVES
<p>Problem Solving, Design, Troubleshooting, Research and Development, and Experimentation</p> <ul style="list-style-type: none"> Discuss the many interpretations associated with the word “design.” Describe the elements associated with the engineering design process. Use appropriate resources to troubleshoot a product or system. Apply the scientific method in an experiment. 	<p>The Engineering and Design Process</p> <ul style="list-style-type: none"> Watch video: Harley Davidson . . and answer questions Engineering Design Challenge 	<p>8,9,10,11</p>	Design is a creative planning process that leads to useful products and systems. (8-E)	Explain that design is a creative planning process that leads to useful products and systems.
	There is no perfect design. (8-F)		Explain why there is no perfect design.	
	Requirements for a design are made up of criteria and constraints. (8-G)		Explain that requirements for a design are made up of criteria and constraints.	
	Design involves a set of steps that can be performed in different sequences and repeated when needed. (9-F)		Explain that design involves a set of steps that can be performed in different sequences and repeated when needed.	
	Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum. (9-G)		Explain that brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.	
	Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions. (9-H)		Explain that modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.	
	Apply a design process to solve problems in and beyond the laboratory-classroom. (11-H)		Apply the engineering design process to solve a problem.	
		Identify and describe the major steps in the engineering design process.		
	<p>Troubleshooting</p> <ul style="list-style-type: none"> Review troubleshooting basics Review use of owners manuals Demo test equipment Intro. troubleshooting activity Troubleshooting activity 	<p>2,10,12</p>	Malfunctions of any part of a system may affect the function or quality of the system. (2-Q)	Explain that malfunctions of any part of a system may affect the function or quality of the system.
	Maintenance is a process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability. (2-U)		Explain that maintenance is a process of inspecting and servicing a product or system on a regular basis in order for it to continue functioning properly, to extend its life, or to upgrade its capability.	
	Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technology system. (10-F)		Identify and describe the basic procedures used to troubleshoot a product or system.	
	Use information provided to manuals, protocols, or by experienced people to see and understand how things work. (12-H)		Explain, apply and evaluate the troubleshooting process in new situations	
	Use tools, materials, and machines safely to diagnose, adjust, and repair systems. (12-I)		Troubleshoot a product or device that is not working.	
	Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task.			
<p>Experimentation</p> <ul style="list-style-type: none"> “TWINKIES” experiments Conduct and experiment and maintain a journal. 	<p>10,12</p>	Some technological problems are best solved through experimentation. (10-H)	Explain, apply, and evaluate the experimental design process in new situation.	
Use tools, materials, and machines safely to diagnose, adjust, and repair systems. (12-I)		Apply the scientific method in an experiment.		

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Unit 4

UNIT/UNIT OBJECTIVES	LESSON/ LESSON ACTIVITIES	STDS	BENCHMARKS ADDRESSED	LESSON OBJECTIVES
<p>Let's Invent and Innovate</p> <ul style="list-style-type: none"> • Apply a design process in the invention or innovation of a product or system. • Safely use tools, materials, equipment and other technology resources in the invention or innovation of a product or system. • Maintain an “inventors notebook” (portfolio) that details an invention or innovation. 	<p>Cool Gadgets!</p> <ul style="list-style-type: none"> • Tell stories of great inventions. Present and invention and have students come with five related “fantasy” inventions. Research and develop a presentation on a “cool gadget” 	<p>1,3,9,11, 19</p>	<p>Corporations can often create demand for a product by bringing it onto the market and advertising it. (1-I)</p> <p>Technological ideas are sometimes protected through the process of patenting. (3-I)</p> <p>Design involves a set of steps that can be performed in different sequences and repeated when needed. (9-F)</p> <p>Apply a design process to solve problems in and beyond the laboratory-classroom. (11-H)</p> <p>Marketing a product involves informing the public about it as well as assisting in selling and distributing it. (19K)</p>	<p>Explain that corporations can often create demand for a product by bringing it onto the market and advertising it.</p> <p>Explain that technological ideas are sometimes protected through the process of patenting.</p> <p>Identify and describe the steps in the engineering design process.</p> <p>Make a product or system and document the process.</p> <p>Explain that Marketing a product involves informing the public about it as well as assisting in selling and distributing it.</p> <p>Identify and describe the attributes of an inventor or innovator.</p>
	<p>Rube Goldberg Challenge</p> <ul style="list-style-type: none"> • Lecture/demonstration on Rube Goldberg • Play game “Mousetrap” • Complete Rube Goldberg Challenge 	<p>11,12</p>	<p>Apply a design process to solve problems in and beyond the laboratory-classroom. (11-H)</p> <p>Select criteria and constraints for the design. (11-I)</p> <p>Make two-dimensional and three-dimensional representations of the design solution. (11-J)</p> <p>Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. (11-K)</p> <p>Make a product or system and document the process. (11-L)</p> <p>Safely use tools, products, and systems for specific tasks. (12-E)</p> <p>Use computers and calculators in order to achieve a given purpose. (12-J)</p>	<p>Apply a design process to solve problems in and beyond the laboratory-classroom.</p> <p>Select criteria and constraints for the design.</p> <p>Make two-dimensional and three-dimensional representations of the design solution.</p> <p>Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.</p> <p>Make a product or system and document the process.</p> <p>Safely use tools, products, and systems for specific tasks.</p> <p>Use computers and calculators in order to achieve a given purpose.</p> <p>Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task</p>
	<p>Stuck on a Deserted Island</p> <ul style="list-style-type: none"> • Students review “Worst-Case Scenario Survival Handbook or watch episodes of Gilligan’s Island • Develop one or more products or systems 	<p>11,12</p>	<p>Apply a design process to solve problems in and beyond the laboratory-classroom. (11-H)</p> <p>Select criteria and constraints for the design. (11-I)</p> <p>Make two-dimensional and three-dimensional representations of the design solution. (11-J)</p> <p>Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed. (11-K)</p> <p>Make a product or system and document the process. (11-L)</p> <p>Safely use tools, products, and systems for specific tasks. (12-E)</p> <p>Use computers and calculators in order to achieve a given purpose. (12-J)</p>	<p>Make a product or system and document the process.</p> <p>Select criteria and constraints for the design.</p> <p>Make two-dimensional and three-dimensional representations of the design solution.</p> <p>Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.</p> <p>Make a product or system and document the process.</p> <p>Safely use tools, products, and systems for specific tasks.</p> <p>Use computers and calculators in order to achieve a given purpose.</p> <p>Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task.</p>

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Unit 5

UNIT/UNIT OBJECTIVES	LESSON/ LESSON ACTIVITIES	STDS	BENCHMARKS ADDRESSED	LESSON OBJECTIVES
<p>Impacts of Invention and Innovation</p> <ul style="list-style-type: none"> Choose and invention or innovation and discuss how it has impacted society. Describe important inventions and innovations in medical technologies and agricultural/biotech nologies that have impacted our lives. Describe the life cycle of a product. Discuss the importance of using data in making meaningful decisions. 	<p>Soda Pop</p> <p>Poster on inventions and innovations related to soda pop.</p> <p>Student view National Inventors Hall of Fame Website</p> <p>Where Does the Trash Go?</p> <p>Discussion: Disposal options for unwanted products</p> <p>Students view “Fast Facts About Trash” website</p> <p>Discuss “Earth Day”</p> <p>Research and record information on three waste materials</p>	4,5,6,12, 14,15	Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences. (4-E)	Explain that technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.
			The use of technology affects humans in various ways, including safety, choices, and attitudes about technology’s development and use. (4-D)	Describe, analyze and evaluate the impacts that inventions and innovations have had on humans.
			The development and use of technology poses ethical issues. (5-F)	Explain that the development and use of technology poses ethical issues.
			Social and cultural priorities and values are reflected in technological devices. (6-F)	Describe, analyze and evaluate the impacts that inventions and innovations have had on society.
			Use computers and calculators in order to achieve a given purpose. (12-J)	Use computers and calculators in order to achieve a given purpose.
			Advances and innovations in medical technologies are used to improve healthcare. (14-G)	Identify advances and innovations in medical technologies and provide examples of how they improve healthcare.
			Technological advances in agriculture directly affect the time and number of people required to produce food for a large population. (15-F)	Explain that technological advances in agriculture directly affect the time and number of people required to produce food for a large population.
			A wide range of specialized equipment and practices is used to improve the production of food, fiber, fuel, and other products and in the care of animals. (15-G)	Explain that a wide range of specialized equipment and practices is used to improve the production of food, fiber, fuel, and other products and in the care of animals.
				Research and report on the impacts of a technological device system or product. Describe the life cycle of a product.
		3,4,5,13	The development and use of technology poses ethical problems. (3-F)	Cite examples of the development and use of technology posing ethical problems.
			Knowledge gained from other fields of study has direct effect on the development of technological products and systems. (4-F)	Explain that knowledge gained from other fields of study has direct effect on the development of technological products and systems.
			Economic, political, and cultural issues are influenced by the development and use of technology. (4-G)	Describe how economic, political, and cultural issues are influenced by the development and use of technology.
			The management of waste produced by technological systems is an important societal issue. (5—D)	Discuss the impacts of “waste materials” on the environment.
			Technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems. (5-E)	Describe how various “waste materials” can be recycled, reused, or re-manufactured into new products.
			Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another. (5-F)	Describe, analyze and evaluate the impacts that inventions and innovations have had on the environment.
Use data collected to analyze and interpret trends in order to identify positive or negative effects of a technology. (13-G)	Use data collected to analyze and interpret trends in order to identify positive or negative effects of a technology.			
Interpret and evaluate the accuracy of the information obtained and determine if it is useful. (13-I)	Interpret and evaluate the accuracy of the information obtained and determine if it is useful.			
	Contribute to a group endeavor by offering useful ideas, supporting the efforts of others, and focusing on the task.			