

Course/Subject: Engineering By Design **Grade Levels: 7 and 8**

Textbook(s) / Instructional Materials Used: Various online resources: code.org, ideafinder.com/history, edison.rutgers.edu/docsamp.htm, tinkercad.com

Month(s): **Unit 1 – Technology Introduction**

Technology Introduction

<u>Big Idea</u>	<u>Standards</u>	<u>Eligible Content</u>	<u>Essential Questions & Lesson Essential Question</u>	<u>Skills/ Competencies</u>	<u>Assessments</u>
<p>Big Idea: Students will develop a deeper understanding of the foundations of what technology is and is not. The historical development of technology over time.</p>	<p>ITEEA</p> <ol style="list-style-type: none"> 1. The students will develop an understanding of the characteristics and scope of technology. (STL 1) 2. Students will develop the core concepts of technology. (STL2) 3. Students will develop and understanding of the relationships among technologies and connections between technology and other fields of study. (STL 3) 7. Student will develop an understanding of technology on history (STL 7) <p>ISTE</p> <p>2C Students will demonstrate an understanding of an respect for the rights and obligations of using and sharing</p>		<p>Objectives: Students will...</p> <p>Define technology.</p> <p>Examine the nature and scope of technology:</p> <ul style="list-style-type: none"> • understand that technology is used to extend the human capability. • Technology is designed to solve a problem for human kind. • Examine the development of technology over a time frame from Stone age to current times. (Looking at the exponential growth curve of technology). <p>Essential Questions: What is technology?</p> <p>What is the nature and</p>	<p>Vocab: Technology</p> <ul style="list-style-type: none"> • Determine what is technology • Determine what is not technology. <p>Examine STEM and its impact on historical discoveries and advancements</p>	<ul style="list-style-type: none"> • Research-Presentation of information. <ul style="list-style-type: none"> ○ Science ○ Technology ○ Engineering ○ Math <p>Classroom Performance Grade</p>

	<p>intellectual property.</p> <p>3A Students will plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.</p> <p>3B Student will evaluate the accuracy, perspective, credibility and relevance of information, media, data or other resources.</p> <p>3C Student will curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.</p> <p>3D Student will build knowledge by actively exploring real world issues and problems, developing ideas and theories and pursuing answers and solutions.</p> <p>6A Students will choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.</p>		<p>scope of technology in history?</p>		
<p>Month(s):</p>			<p>Unit 2 – Inventions & Innovations</p>		

Inventions & Innovations

<u>Big Idea</u>	<u>Standard</u>	<u>Eligible Content</u>	<u>Essential Questions & Lesson Essential Question</u>	<u>Skills/ Competencies</u>	<u>Assessments</u>
<p>Students will understand that an invention is something that is brand new and unique and has not existed before. Student will understand that an innovation is the changes that occur to inventions over time.</p>	<p>ITEEA</p> <ol style="list-style-type: none"> 1. The students will develop an understanding of the characteristics and scope of technology. (STL 1) 2. Students will develop the core concepts of technology. (STL 2) 3. Students will develop and understanding of the relationships among technologies and connections between technology and other fields of study. (STL 3) 7. Student will develop an understanding of technology on history (STL 7) <p>ISTE</p> <p>1D Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.</p>		<p>Objectives: Students will... Define technology. Examine phone development and change over time. Explore innovation.</p> <p>Essential Question: EQ: What is technology?</p> <p>Students will understand that an invention is a new unique item and innovation changes the invention over time.</p> <ul style="list-style-type: none"> ● Exploring the use of innovation and design as a method for continuous improvement. ● Examine the timeline of phone development from origination to today. 	<p>Vocab:</p> <ul style="list-style-type: none"> ● Invention ● innovation ● rotary phone ● speed dial ● caller ID ● wireless phone 	<p>Exit Ticket: Students identify and create a timeline demonstrating this process.</p> <p>Example: Record to MP3</p>

Month(s):

Unit 3 – Great Thinkers and Their Inventions

Great Thinkers and Their Inventions

<u>Big Idea</u>	<u>Standards</u>	<u>Eligible Content</u>	<u>Essential Questions & Lesson Essential Question</u>	<u>Skills/ Competencies</u>	<u>Assessments</u>
<p>Students will understand the design thinking process that great inventors have used to create innovative creations and their reasons for their inventions.</p>	<p>ITEEA</p> <ol style="list-style-type: none"> 1. The students will develop an understanding of the characteristics and scope of technology. (STL 1) 2. Students will develop the core concepts of technology. (STL 2) 3. Students will develop and understanding of the relationships among technologies and connections between technology and other fields of study. (STL 3) <p>ISTE</p> <p>2b Students will engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.</p> <p>6D Publish or present content that customizes the message and medium for their intended audiences.</p>		<p>Objective: Students will... Examine the innovations of the past. Explore how society has changed over time based upon innovations. Examine how innovations have been redesigned over time.</p> <p>Essential Questions: EQ: What is technology?</p> <p>Students will read about Inventors and their inventions, and make observations on how innovation has changed the invention over time.</p> <p>Students will examine the use of technology to enhance the peoples lives.</p>	<p>Research: Clarence Crane (Lifesaver) Earle Dickson (Bandaid) Chester Greenwood (earmuffs) William Russell (Frisbie)</p>	<p>Student selection of additional inventor and their inventions:</p> <p>Station Rotation: Direct Independent Collaboration</p>

Month(s):

Unit 4 - Measurement

Measurement

<u>Big Idea</u>	<u>Standards</u>	<u>Eligible Content</u>	<u>Essential Questions & Lesson Essential Question</u>	<u>Skills/ Competencies</u>	<u>Assessments</u>
Students will understand how to use measuring systems in technology and how measurement is used in design.	ITEEA #8 Students will develop an understanding of the attributes of design.		Objectives: Students will... Understand measuring systems and accuracy. Essential Question: EQ: Students will learn the importance of accuracy in design through using measurement devices.	Students will learn how to read a ruler and take length measurements.	Ruler Game https://www.rulergame.net/new-english-ruler-game.php

Month(s):	Unit 5 - TinkerCAD
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TinkerCAD

<u>Big Idea</u>	<u>Standards</u>	<u>Eligible Content</u>	<u>Essential Questions & Lesson Essential Question</u>	<u>Skills/ Competencies</u>	<u>Assessments</u>
Students will use TinkerCAD to assist them in creating a concept that is real world and share it with others.	ITEEA ISTE 1C- Students will use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways. 1D- Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current		Objectives: Students will.... Examine the use of digital resources in the design process. Explore the TinkerCad program Essential Questions: EQ: How does TinkerCAD help with explaining your ideas and developing prototypes? Students will utilize computer aided design software to	Students will design a 3D part in TinkerCAD	Creation of a 3D part in TinkerCAD

	<p>technologies and are able to transfer their knowledge to explore emerging technologies.</p> <p>2A Students cultivate and manage their digital identify and reputation and are aware of the permanence of their actions in the digital world.</p> <p>2B- Students engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.</p> <p>2C- Students demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.</p> <p>3D- Students manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.</p> <p>4A- Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.</p> <p>4B- Students select and use</p>		<p>design parts for a design challenge.</p>		
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	<p>digital tools to plan and manage a design process that considers design constraints and calculated risks.</p> <p>4C- Students develop, test and refine prototypes as part of a cyclical design process.</p> <p>4D- Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open ended problems.</p> <p>5A- Students formulate problem definitions suited for technology assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.</p> <p>5B- Students collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem solving and decision making.</p> <p>5C- Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate</p>				
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	<p>problem solving.</p> <p>5D- Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.</p> <p>6B- Students create original works or responsibly repurpose or remix digital resources into new creations.</p> <p>6C- Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models, or simulations.</p> <p>7C- Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.</p> <p>7D- Students explore local and global issues and use collaborative technologies to work with others to investigate solutions.</p>				
Month(s):			Unit 6 - Journaling		
Journaling					

<u>Big Idea</u>	<u>Standards</u>	<u>Eligible Content</u>	<u>Essential Questions & Lesson Essential Question</u>	<u>Skills/ Competencies</u>	<u>Assessments</u>
<p>Students will learn how to properly create an engineering design journal, and document their progress when working on a group project.</p>	<p>ITEEA</p> <p>8. Students will develop an understanding of the attributes of design.</p> <p>9. Students will develop an understanding of engineering design.</p> <p>10. Students will develop an understanding of the role of trouble shooting, research and development, invention and innovation, and experimentation in problem solving.</p> <p>ISTE</p> <p>1C- Students will use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.</p> <p>2B- Students engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices</p> <p>4A- Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.</p>		<p>Objectives: Students will.... Learn the Engineering Design process</p> <p>Produce a journal that helps focus and plan the innovative project using the engineering design process.</p> <p>Essential Questions: EQ: How was the Engineering Design Process (EDP) used in you project?</p> <p>EQ: What needs to be considered in making a good journal entry?</p>	<ul style="list-style-type: none"> • Engineering Design Process • Orthographic sketching • Isometric sketching • Patent, Trademark, & Copyright 	<p>Student Journal</p>

Month(s):		Unit 7 - Project			
Project					
<u>Big Idea</u>	<u>Standards</u>	<u>Eligible Content</u>	<u>Essential Questions & Lesson Essential Question</u>	<u>Skills/ Competencies</u>	<u>Assessments</u>
Students working in small groups will design and prototype an invention.	<p>ITEEA</p> <p>8. Students will develop an understanding of the attributes of design.</p> <p>9. Students will develop an understanding of engineering design.</p> <p>10. Students will develop an understanding of the role of trouble shooting, research and development, invention and innovation, and experimentation in problem solving.</p> <p>11. Students will develop the abilities to apply the design process.</p> <p>ISTE</p> <p>4A- Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.</p> <p>4B- Students select and use</p>		<p>Objective: Students will... Develop empathy with and understanding of users.</p> <p>Use the problem solving process to design an invention to help solve a problem.</p> <p>Essential Questions: EQ: Explain how invention and innovation are creative ways to turn ideas into real things?</p>	Students will learn how to use the tools and materials to make a working prototype. Students will apply the concepts of journaling.	Self and peer evaluation

	<p>digital tools to plan and manage a design process that considers design constraints and calculated risks.</p> <p>4C- Students develop, test and refine prototypes as part of a cyclical design process.</p> <p>4D- Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open ended problems.</p> <p>5A- Students formulate problem definitions suited for technology assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.</p> <p>5C- Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem solving.</p> <p>6C- Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models, or</p>				
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	simulations. 7C- Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.				
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Month(s):	Unit 8 - Coding
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Coding

<u>Big Idea</u>	<u>Standard</u>	<u>Eligible Content</u>	<u>Essential Questions & Lesson Essential Question</u>	<u>Skills/ Competencies</u>	<u>Assessments</u>
Students will use the problem solving process to design an app focused on empathy.	Code.org - CS Discoveries Unit 4 Ch 1 Lesson 1-7 ITEEA 6. The role of society in the development and use of technology. 11. Apply the design process. 12. Use and maintain technological products and systems. 17. Information and communication technologies. ISTE 1.A. Empowered Learner Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning		Objectives: Students will.... View computer science as a tool for social impact. Develop empathy with and understanding of users. Appreciate the many roles in software development. Essential Questions: <ul style="list-style-type: none"> How do designers identify the needs of their user? How can we ensure that a user's needs are met by our designs? What processes will best allow us to efficiently create, test, and iterate upon our designs? How do teams effectively work together to develop software? 	Design Process Empathy Protoyping	Pre and post test

	<p>goals, informed by the learning sciences. Students: articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes.</p> <p>1.B. build networks and customize their learning environments in ways that support the learning process.</p> <p>1.C. use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.</p> <p>1.D. understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.</p> <p>2.B Digital Citizen Students recognize the rights, responsibilities and opportunities of living, learning and working in an interconnected digital world, and they act and model in</p>		<ul style="list-style-type: none"> • What roles beyond programming are necessary to design and develop software? • How do designers incorporate feedback into multiple iterations of a product? 		
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	<p>ways that are safe, legal and ethical. Students engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.</p> <p>2C Students demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.</p> <p>3.A Knowledge Constructor Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others. Students: plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.</p> <p>3.C. Students: curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.</p> <p>3.D Students: build knowledge by actively</p>				
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	<p>exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.</p> <p>4A: Innovative Designer Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions. Students: Know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.</p> <p>4B: Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.</p> <p>4C: Students develop, test and refine prototypes as part of a cyclical design process.</p> <p>4D: Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.</p> <p>5A Computational Thinker: Students develop and employ strategies for</p>				
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	<p>understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions. Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.</p> <p>5C: Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem solving.</p> <p>5D: Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.</p> <p>6A Creative Communicator Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals. Students choose the appropriate platforms and tools for meeting the</p>				
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	<p>desired objectives of their creation or communication.</p> <p>6B: Students create original works or responsibly repurpose or remix digital resources into new creations.</p> <p>6C: Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.</p> <p>6D: Students publish or present content that customizes the message and medium for their intended audiences.</p> <p>7A: Global Collaborator: Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working efficiently in teams locally and globally. Students use digital tools to connect with learners from a variety of backgrounds and cultures, engaging with them in ways that broaden mutual understanding and learning.</p> <p>7B: Students: use collaborative technologies to work with others,</p>				
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<p>The students will create prototype solutions with real users to gain feedback.</p>	<p>including peers, experts or community members, to examine issues and problems from multiple viewpoints.</p> <p>7C: Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.</p> <p>Code.org - CS Discoveries Unit 4 Ch 2 Lesson 8-16</p> <p>ITEEA 6. The role of society in the development and use of technology. 11. Apply the design process. 12. Use and maintain technological products and systems. 17. Information and communication technologies.</p> <p>ISTE 1.A. Empowered Learner Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences. Students: articulate and set personal learning goals,</p>		<p>Objectives: Students will.... View computer science as a tool for social impact. Develop empathy with and understanding of users. Appreciate the many roles in software development. Essential Questions:</p> <ul style="list-style-type: none"> • How do teams effectively work together to develop software? • What roles beyond programming are necessary to design and develop software? • How do designers incorporate feedback into multiple iterations of a product? 	<p>Research Prototyping App Creation</p>	<p>Pre and post test</p>
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	<p>develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes.</p> <p>1.B. build networks and customize their learning environments in ways that support the learning process.</p> <p>1.C. use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.</p> <p>1.D. understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.</p> <p>2.B Digital Citizen Students recognize the rights, responsibilities and opportunities of living, learning and working in an interconnected digital world, and they act and model in ways that are safe, legal and ethical. Students engage in positive, safe, legal and ethical behavior</p>				
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	<p>when using technology, including social interactions online or when using networked devices.</p> <p>2C- Students demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.</p> <p>3.A Knowledge Constructor Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others. Students: plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.</p> <p>3.C. Students: curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.</p> <p>3.D Students: build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and</p>				
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	<p>solutions.</p> <p>4A: Innovative Designer Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions. Students: Know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.</p> <p>4B: Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.</p> <p>4C: Students develop, test and refine prototypes as part of a cyclical design process.</p> <p>4D: Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.</p> <p>5A Computational Thinker: Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to</p>				
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	<p>develop and test solutions. Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.</p> <p>5C: Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem solving.</p> <p>5D: Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.</p> <p>6A Creative Communicator Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals. Students choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.</p> <p>6B: Students create original</p>				
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	<p>works or responsibly repurpose or remix digital resources into new creations.</p> <p>6C: Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.</p> <p>6D: Students publish or present content that customizes the message and medium for their intended audiences.</p> <p>7B: Students: use collaborative technologies to work with others, including peers, experts or community members, to examine issues and problems from multiple viewpoints.</p> <p>7C: Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.</p> <p>7D: Explore local and global issues and collaborative technologies to work with other to investigate solutions.</p>				
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