

**Warren Township Public School District**  
**Curriculum**

<b>Subject: Innovation and Design</b>	<b>Grade: 6</b>	<b>Unit: Engineering and Design Process</b>
<b>Total Number of Lessons: 25</b>	<b>Unit Time Frame: Intro and Closing Lessons 6 Days; 3 Centers: SketchUp, Earthquake, Crazy Contraptions - 8 Days Each</b>	

**Instructional Materials:**

General Materials:

- Google Classroom
- Teacher created slide presentation
- Teacher created worksheets and supporting materials
- Student laptop computers, wireless mouse
- Collaboration Rubric

SketchUp Materials:

- Technology Interactions Textbook/CD (Glencoe)
- SketchUp for Schools
- Teacher created video tutorials
- Project Rubric

Earthquake Tower Materials: (Pitsco)

- DVD: Earthquake Tower Teacher Guide
- Earthquake Tower Kit
- Earthquake Simulator
- Project Rubric

Crazy Contraption Materials:

- Activity Guide
- Design Portfolio
- Activity Pack
- Project Rubric
- Rube Goldberg Dynamic STEM interactive build

Goals:	Skills / Understandings
<ul style="list-style-type: none"> <li>• Introduction to the Innovation and Design <ul style="list-style-type: none"> <li>◦ Invention vs. Innovation</li> <li>◦ Identify fields</li> <li>◦ Identify that anyone can be a part of the STEAM fields (Diversity and Inclusion)</li> </ul> </li> <li>• Undertake design projects, utilizing the engineering and design process, to construct and/or implement a solution that meets specific design criteria and constraints. <ul style="list-style-type: none"> <li>◦ Create a 3D house in a CAD program</li> <li>◦ Create a 5 story tower to test earthquake resistance</li> <li>◦ Create a Crazy Contraption that incorporates 4 mechanisms</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Introduction to Innovation and Design <ul style="list-style-type: none"> <li>◦ Identify the difference between an Invention and Innovation</li> <li>◦ Identify fields associated with STEAM</li> <li>◦ Discuss inclusivity within the STEAM field through a discussion on famous architects</li> </ul> </li> <li>• Collaboration <ul style="list-style-type: none"> <li>◦ Responsibility for oneself</li> <li>◦ Contribution of ideas</li> <li>◦ Listening and discussion</li> <li>◦ Cooperation</li> </ul> </li> <li>• Design Process <ul style="list-style-type: none"> <li>◦ Complete 3 design projects</li> <li>◦ Identify the criteria and constraints for each project</li> </ul> </li> <li>• SketchUp: Create a 3D house in a CAD program <ul style="list-style-type: none"> <li>◦ Define CAD</li> <li>◦ Explain the difference between 2D and 3D CAD programs</li> <li>◦ Identify different industries that use CAD programs</li> <li>◦ Identify parts of SketchUp <ul style="list-style-type: none"> <li>▪ Orbit, pan, zoom, select, drawing tools, paint, erase, push/pull, follow me, 3D warehouse, move, rotate,</li> </ul> </li> <li>◦ Create a cube using specific dimensions.</li> <li>◦ Use the line, auto shape, and follow me tools to create piping using specific dimensions.</li> <li>◦ Design a pool with a slide using follow-me and auto-shape tools.</li> <li>◦ Create a L-shaped house with a pitched roof line using the rectangle tool, push-pull, lines, and move tool</li> <li>◦ Create gutters around the roof line using the line and follow-me tool.</li> <li>◦ Import a door from the 3D warehouse, move, place, rotate, and scale.</li> <li>◦ Apply the CAD skills to create the exterior of a 3-Dimensional house within architectural parameters, including landscaping.</li> </ul> </li> <li>• Earthquake Tower <ul style="list-style-type: none"> <li>◦ Use the terms accurately associated with Earthquakes to the construction of their towers.</li> </ul> </li> </ul>

- Identify the structural supports, column, beams, diagonal supports.
- Create a template for building a 5 story tower.
- Identify and use a timber cutter used in construction.
- Critique and reflect on the completed model tower.
- Crazy Contraptions
  - Use the terms accurately associated with mechanisms
  - Describe and design a simple machine.
  - Identify and use a screwdriver, multi-cutter, and reamer used in construction.
  - Create a contraption with 4 simple machines that have kinetic energy transferred from one object to another by collision.
  - Write a reflection on the design process.

### **NJ Student Learning Standards and Descriptions:**

#### **NJSLS**

“What is an Innovation?”

- 9.4.8.CI.2: Repurpose an existing resource in an innovative way

Famous architects and Engineers

- 8.1.8.IC.2: Describe issues of bias and accessibility in the design of existing technologies.
- 9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries.
- 9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect

Design Process

- MS-PS1-6 Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.
- 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.
- 8.2.8.ED.5: Explain the need for optimization in a design process.
- MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution

Collaboration

- NJSLSA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- SL.6.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.
- 8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team (by the end of Grade 8)

All Centers: Research

- RL.6.1. Cite textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.
- NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

- NJSLSA.L4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate
- NJSLSA.L6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.
- NJSLSA.L5. Demonstrate understanding of word relationships and nuances in word meanings.

#### Earthquake Center

- MS-PS1-3 Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.
- MS-ETS1-1 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-ESS2-4 Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

#### Crazy Contraptions Center:

- 8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team.
- 8.2.8.ED.6: Analyze how trade-offs can impact the design of a product.
- MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- 9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option
- MS-ETS1-4 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.
- 8.1.8.AP.6: Refine a solution that meets users' needs by incorporating feedback from team members and users.
- MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

#### Analyzing Projects/Data

- MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence
- 8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.
- 8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
- MS-ETS1-3 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.

Unit Essential Questions:	Student Vocabulary:	Lesson Learning Statement::
<ul style="list-style-type: none"> <li>How can I use the engineering design process to solve problems?</li> <li>Why are collaboration skills important? <ul style="list-style-type: none"> <li>SketchUp: How is CAD used in different industries? What are the benefits of using a CAD program?</li> <li>Earthquake Towers: How can I design a building to be structurally sound?</li> <li>Crazy Contraptions: How can I create a simple machine?</li> </ul> </li> </ul>	<p><b>General</b></p> <ul style="list-style-type: none"> <li>Objectives</li> <li>Design Process <ul style="list-style-type: none"> <li>Research</li> <li>Brainstorm</li> <li>Design</li> <li>Construct a Model</li> <li>Test and Evaluate</li> <li>Redesign</li> <li>Communicate Ideas</li> </ul> </li> <li>Criteria</li> <li>Constraints</li> <li>Collaboration</li> </ul> <p><b>SketchUp Center</b></p> <ul style="list-style-type: none"> <li>CAD (Computer Aided-Design)</li> <li>Orbit</li> <li>Pan</li> <li>Extrude</li> <li>Scale</li> </ul> <p><b>Earthquake Center</b></p> <ul style="list-style-type: none"> <li>Force</li> <li>Load</li> <li>Pressure</li> <li>Trusses</li> <li>Stable</li> <li>Unstable</li> <li>Seismology</li> <li>Seismologist</li> <li>Compression</li> <li>Bending</li> <li>Torsion</li> <li>Shear</li> </ul>	<ul style="list-style-type: none"> <li>Collaboration: I recognize that I need to have positive collaboration skills in order to complete my project well.</li> <li>Design Process: I understand the steps of the design process and can apply them to my project.</li> <li>SketchUp: I will use my skills I have learned in the CAD program to create a 3D house.</li> <li>Earthquake Tower: I will create a stable structure that uses columns, beams, and diagonal supports.</li> <li>Crazy Contraptions: I will create a simple machine that has four moving parts.</li> </ul>

	<p><b>Crazy Contraption Center</b></p> <ul style="list-style-type: none"> <li>• Contraption</li> <li>• Mechanism</li> <li>• Lever</li> <li>• Pulley</li> <li>• Gear</li> </ul>	
<b>Interdisciplinary Concepts:</b>	<b>Assessment Strategies / Resources:</b>	<b>Benchmark Assessments / Products:</b>
<ul style="list-style-type: none"> <li>• NJSLA.L6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression. <ul style="list-style-type: none"> <li>○ Students will be reading and synthesizing definitions of key terms.</li> </ul> </li> <li>• MS-PS1-6 Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. <ul style="list-style-type: none"> <li>○ Students will create a SketchUp House, Earthquake Tower, and a Crazy Contraptions</li> </ul> </li> <li>• NJSLA.SL1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. <ul style="list-style-type: none"> <li>○ Students will work collaboratively to create an Earthquake Tower and a Crazy Contraption.</li> </ul> </li> </ul>	<p>SketchUp: Research Worksheet, Teacher Observations, House Project Rubric</p> <p>Earthquake Tower: Research Worksheet, Teacher Observations, Collaboration Rubric, Project Rubric</p> <p>Crazy Contraptions: Design Portfolio, Teacher Observations, Collaboration Rubric, Project Rubric, Reflection</p>	<p>SketchUp:</p> <ul style="list-style-type: none"> <li>• Research</li> <li>• Completion of Video Lessons</li> <li>• House Project Rubric</li> </ul> <p>Earthquake Tower:</p> <ul style="list-style-type: none"> <li>• Research</li> <li>• Concept Sketch</li> <li>• Template</li> <li>• Project Rubric</li> <li>• Collaboration Rubric</li> </ul> <p>Crazy Contraptions:</p> <ul style="list-style-type: none"> <li>• Research</li> <li>• Design</li> <li>• Project Rubric</li> <li>• Collaboration Rubric</li> </ul>

<ul style="list-style-type: none"> <li>MS-ETS1-3 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.           <ul style="list-style-type: none"> <li>Students will reflect on the completed projects.</li> </ul> </li> </ul>		
---	--	--

**21st Century Life and Careers - [Technology](#) (link to standard 8.1 and 8.2) / [Career and 21st Century Skills](#) (link to standard 9.1, 9.2, 9.2)**  
**(Include standard number and activity examples from each area):**

- Relevant standards are addressed above.

**[Modifications for Special Education Students, English Language Learners, and Gifted Students: Warren QSAC Accommodations Chart](#):**

- Modifications and accommodations as listed in their IEP
  - Alternate Materials for Earthquake Tower Project: Building Blocks
  - Alternate Materials for Crazy Contraption Project: K'nex Blocks
- Small Group instruction
- Modeling
- Individual achievement