

**Warren Township Public School District
Curriculum**

Subject: Innovation and Design	Grade: 6	Unit: Engineering and Design Process
Total Number of Lessons: 25	Unit Time Frame: Intro and Closing Lessons 6 Days; 3 Centers: SketchUp, Earthquake, Crazy Contraptions - 8 Days Each	
Instructional Materials:		
General Materials: <ul style="list-style-type: none">● Google Classroom● Teacher created slide presentation● Teacher created worksheets and supporting materials● Student laptop computers, wireless mouse● Collaboration Rubric SketchUp Materials: <ul style="list-style-type: none">● Technology Interactions Textbook/CD (Glencoe)● SketchUp for Schools● Teacher created video tutorials● Project Rubric Earthquake Tower Materials: (Pitsco) <ul style="list-style-type: none">● DVD: Earthquake Tower Teacher Guide● Earthquake Tower Kit● Earthquake Simulator● Project Rubric Crazy Contraption Materials: <ul style="list-style-type: none">● Activity Guide● Design Portfolio● Activity Pack● Project Rubric● Rube Goldberg Dynamic STEM interactive build		

Revised: August 25, 2025

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

- 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 Descriptors:

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

	Crazy Contraption Center <ul style="list-style-type: none"> • Contraption • Mechanism • Lever • Pulley • Gear 	
Interdisciplinary Concepts:	Assessment Strategies / Resources:	Benchmark Assessments / Products:
<ul style="list-style-type: none"> • 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. <ul style="list-style-type: none"> ○ Students will be reading and synthesizing definitions of key terms. • 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"> ○ Students will create a SketchUp House, Earthquake Tower, and a Crazy Contraptions • 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. <ul style="list-style-type: none"> ○ Students will work collaboratively to create an Earthquake Tower and a Crazy Contraption. 	<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"> • Research • Completion of Video Lessons • House Project Rubric <p>Earthquake Tower:</p> <ul style="list-style-type: none"> • Research • Concept Sketch • Template • Project Rubric • Collaboration Rubric <p>Crazy Contraptions:</p> <ul style="list-style-type: none"> • Research • Design • Project Rubric • Collaboration Rubric

<ul style="list-style-type: none"> 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"> Students will reflect on the completed projects. 		
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):		
<ul style="list-style-type: none"> Relevant standards are addressed above. 		
Modifications for Special Education Students, English Language Learners, and Gifted Students: Warren QSAC Accommodations Chart:		
<ul style="list-style-type: none"> Modifications and accommodations as listed in their IEP <ul style="list-style-type: none"> Alternate Materials for Earthquake Tower Project: Building Blocks Alternate Materials for Crazy Contraption Project: K'nex Blocks Small Group instruction Modeling Individual achievement 		