

Rationale: This lesson could work within multiple disciplinary areas in units dealing with Ancient Greek (History), inquiry based research (ELA), strength of shapes and use of angles (Geometry, Tech Ed), and force on a shape with/weight distribution (Science). This lesson was created with students in grades 7-9 in mind.

Lesson Overview: Based on the information provided in the text set and using provided materials, students will research, hypothesize, and create a 2-story structure that holds the weight of a person.

Lesson Standards:

- 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.
- HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
- MS-PS1-1, MS-PS1-4: Develop a model to predict and/or describe phenomena
- RHST 6-8.2: Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
- WHST 6-8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Learning Targets:

- Students will analyze a variety of text to determine how common shapes are used in Greek architecture.
 - *Performance of Understanding: Students will construct a simple structure to hold the weight of textbooks, using design features similar to the Greeks*
- Students will integrate the STEM Engineering Design Process in collaborative teams.
 - *Performance of Understanding: Students will design, plan, test and improve a model design that will withstand the weight of a human.*
- Students will critique their design process and justify their reasoning for the success or failure of the design.

Lesson Resources:

-Text Set

Articles:

<http://www.historyforkids.net/ancient-greek-architecture.html>

<https://www.britannica.com/topic/Parthenon>

<http://www.explainthatstuff.com/howbuildingswork.html>

Videos:

<https://wpt.pbslearningmedia.org/resource/phy03.sci.phys.mfe.zgumdrop/triangles-testing-the-strength-of-a-gumdrop-dome/?#.Wiqy0IWnHIU>

https://www.youtube.com/watch?v=8X_zk-NgtRc

<https://www.youtube.com/watch?v=mkZygOc0rus>

-Building Materials

- Tape, paper, foil, toothpicks, straws, cups, toilet paper rolls, cardboard, water bottles, string newspaper (9)
- Index cards, textbooks
- Cardboard

Assessments:

Formative:

- Building Models

Summative:

- Written Reflection: In a written reflection, describe your design process and provide research for why you chose this method. Describe the outcome of your design and suggestions for improvements you would make in the future.
- Other Options: Checklist/Rubric, [CANVA](#), [Padlet](#)

Lesson Phases:

FL: Reading for Main Ideas and Conclusions

- *Gist: Read like a scientist or engineer who must explain a complex process: identifying main ideas and conclusions. Summarize the content using precise, objective language.*
- *Pyramid Diagram Notes Protocol:*
 - *Pyramid Diagram notes are a process that will help you read like a scientist by selecting the most important information and analyze the implications of this information on your own model!*
 - *Focusing Question: "How are shapes effectively used in the building process?"*

PGW: Text Set Reading

- Jigsaw Readings and used pyramid diagram notes strategy
 - Process: (Build anchor chart for this and provide sample)
 - Distribute index cards for each group. Groups should jigsaw texts and use the note cards to record one piece of information per note card.

- When each text has been “read,” teams should group cards and tape to team anchor chart.
- Brainstorm category headings for each group of cards. Write the heading on a new index card and label the grouping. Tape to chart.
- Draw two more rectangles to represent the top two layers of a pyramid. The title should reflect the overall topic and is placed at the very top. Then using the title, category labels, and details from the reading construct a one sentence summary as a team. Write this summary in the 2nd rectangle.
- *Extension activity: Have students write a one paragraph conclusion that addresses the focusing question, using the one sentence summary as a top*

PGW: Build Prototype

- Create a basic design using index cards and tape to hold textbooks

FL/GI: Whole Group Discussion

- Discuss pros and cons from research and prototype. Refine thinking process.
- Introduce STEM and the ideas/process behind STEM.

PGW/GI: STEM Design for Model 2

- Students draw design plans, build, and test models for task.
- Teacher provides Guided Instruction using Questioning Techniques from DOK Stems

I: Independent Reflection

- Summative Written Reflection
- Extension Option: Improvement Process (This could take days if you want to continue to improve until successful)

Lesson Extension Options:

- Research Newton’s Laws of Motion and connect how they pertain to what we just learned.
- Research the tallest buildings in the world and the structures behind the height? Do these compare to the Greeks?