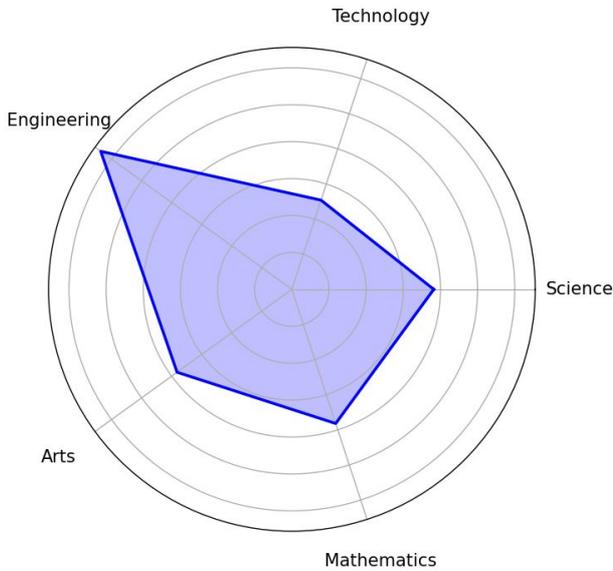




Curricular



Geometric Bridges – Designing Strong Structures

Duration	Age	Difficulty
90	11-12	Medium
#GEOMETRY #ENGINEERING #ART #MATHEMATICS		

DESCRIPTION

In this activity, students will explore how geometry influences the strength and stability of structures. They will analyze real-life bridges, identify geometric shapes used in engineering, and apply their knowledge by building a model bridge using basic materials.

Students will:

- Understand the use of triangles, arches, and polygons in structural design.
- Use geometric reasoning to design and test a paper or cardboard bridge.
- Explore the relationship between geometry, force distribution, and construction.

ACTIVITY OBJECTIVES

- Identify and analyze common geometric shapes in engineering structures.
- Apply basic principles of geometry and engineering in designing a bridge prototype.
- Evaluate and refine designs based on performance and peer feedback.
- Foster teamwork, creativity, and communication skills.
- Understand how mathematical knowledge applies to the real world.

KEY COMPETENCES (EU)

- Mathematical competence and basic competences in science and technology
- Digital competence
- Sense of initiative and entrepreneurship
- Personal, social and learning to learn competence



MATERIALS



Cardboard



Paper straws



Glue



Tape



Scissors



Rulers



Protractors



Weights for testing



Bridge design blueprints (template)



Notebook, pencil, markers



Calculator



“Bridge Geometry Guide” (includes structural shape examples)

- Provided by students
- Provided by the teacher/institution
- Downloadable Elements



“Bridge Test Data Sheet”



“Bridge Sketch Template”

PREVIOUS PREPARATION

- Form groups of 3–4 students.
- Print and distribute the Bridge Geometry Guide.
- Set up a test area (between two tables) to assess bridge resistance.
- The teacher shows a simple bridge as an example.
- Assign rotating roles (designer, builder, recorder, presenter).
- Ensure gender equity, inclusive language, and accessibility for all learners.

CONTEXTUALIZATION AND ADAPTATION

Bridges are a fundamental part of human infrastructure. From Roman aqueducts to modern suspension bridges, geometry has always played a key role in making structures strong and efficient.

Why is geometry important in engineering?

- Shapes like triangles distribute weight and force efficiently.
- Arches and curves provide stability.

Key Questions:

- What shapes appear most often in bridge design?
- How do different shapes affect the strength of a structure?
- Can a paper bridge hold weight? How can we improve it?





ACTIVITY

STEP 1: Introduction and Discussion (15 min)

- Present examples of famous bridges through slides (e.g., Golden Gate, Tower Bridge).
- Explain key geometric shapes and their structural functions.
- Highlight female STEAM role models (e.g., Emily Roebling).

STEP 2: Design (25 min)

- Sketch the bridge using at least two geometric shapes.
- Annotate angles, lengths, and material placement.
- Incorporate an artistic element inspired by a cultural or traditional structure (Incan, Islamic, Romanesque).

STEP 3: Construction (25 min)

- Build the bridge based on the sketch from paper/cardboard based on their plan.
- Decorate the bridge with cultural motifs or commemorative plaques that honor historical female figures.

STEP 4: Testing, reflection and redesign (15 min)

- Test the bridge's resistance using small weights (e.g., coins).
- Complete a self assessment sheet: "What worked well? What would you improve?"
- Groups analyze which parts held up best and why.
- Discuss how geometry helped or hindered the performance.
- Optional Extension (if time allows): Use an online simulator (e.g., Bridge Constructor) to test digital designs.

STEP 5: Presentation (10 min)

- Each group presents their bridge.
- Explain the cultural inspiration, design decisions, and outcomes.
- Highlight inclusive, cultural, and shared leadership elements.

Assessment Rubric (Max. 12 points)

- Correct geometric design (1–4 pts)
- Structural stability and resistance (1–4 pts)
- Collaborative work and oral presentation (1–4 pts)

Peer Assessment

Each group provides feedback to another:

- What works well?
- What could be improved?
- One additional idea



Note for the teacher

- Supervise role rotation with an inclusive and participatory approach.
- Ensure accessibility (contrast materials, assistance in manipulation).
- Avoid stereotypes and emphasize that all people, regardless of gender, can excel in engineering.

Reflection questions

- Which shape was most effective?
- Where did the design fail, and why?
- How would you adapt your bridge to a real-world scenario?
- What did you learn about teamwork and leadership?

CONCLUSION AND SHARING

Prompt students to reflect:

- Which geometric shape was most effective? Why?
- If your bridge failed, where and how did it collapse?
- What real-life bridges inspired your design?

Optional Sharing:

- Share photos and test results online using #GeometricBridgesSTEAM
- Instagram: @steambrace_eu

Don't forget to take a photo of your experience and share it with us!



[LinkedIn](#)



[Instagram](#)



[X](#)



BIBLIOGRAPHY AND REFERENCES

- <https://www.exploratorium.edu/snacks/strong-structures>
- <https://phet.colorado.edu/en/simulation/build-a-bridge>
- “The Power of Triangles in Engineering” (TED-Ed)

