ACTIVITY TITLE: Bridging the Future: Design for Equity and Innovation

Activity Code: ncWITEC02

	DURATION	2.5–3 hours
	AGE RANGE	17–18 years
	TOPICS	Engineering Design Creativity Inclusion Culture

Description of the project

In this collaborative activity, students take on the role of civil engineers to design a bridge that not only works but tells a story of culture, equity, and innovation. They'll explore examples from around the world, learn from traditional structures, and highlight the work of women in engineering. Using either physical materials or digital tools like SketchUp or Tinkercad, students will build and test a scale model of their bridge.

By the end, students will:

- Present a working prototype or digital model
- Demonstrate inclusive, sustainable, and culturally inspired design
- Explain how gender equity shaped their design decisions

Objectives: What will I learn?

- **Apply core engineering and design principles** by designing a functional bridge using physical or digital modeling tools, in order to understand how technical decisions impact real- world infrastructure.

- **Collaborate with peers** by using rotating roles (designer, engineer, researcher, presenter, storyteller) throughout the design process, to promote shared leadership, inclusive teamwork, and communication.

- **Integrate inclusive and cultural features into their bridge designs** by researching global structures and using an Inclusive Design Checklist, to ensure their project reflects equity,

accessibility, and heritage.

- **Use digital tools** such as SketchUp or Tinkercad by building and visualizing a scale bridge model, to enhance digital engineering skills and design accuracy.
- **Highlight the contributions of female engineers** through storytelling and visual tributes, to recognize historically underrepresented role models and promote gender equity in STEM.

Materials: What do I need?

1. Provided by the teacher/institution

- ❖ Prototyping kits (wood sticks, cardboard, glue, string)
- ❖ Measuring tape
- ❖ Weights for load testing
- ❖ Laptops/tablets with SketchUp or Tinkercad access
- ❖ Poster, Bridges Across Cultures: Engineering for Equity

2. Provided by students

- ❖ Notebook and pen
- ❖ Smartphone for documentation
- ❖ Internet access

3. Downloadable Resources

- ❖ Bridge Design Brief
- ❖ Profiles of Women in Engineering
- ❖ Bridge Structure Visual Guide

Previous preparation

- **Introduce the Purpose and Role Models in Inclusive Engineering**

  Students are introduced to the purpose of the project: designing a bridge that represents not just structure but culture, equity, and innovation. To deepen engagement and challenge stereotypes, students explore women in engineering by using the "Profiles of Women in Engineering" worksheet.

- **Form diverse teams and assign rotating roles**

  Organize students into teams of 4–5 members that reflect diversity in gender, background, and experience. Assign rotating roles to ensure each student engages with multiple dimensions of the project, such as:

  o **Designer** – Focuses on layout, symbolism, and aesthetics

  o **Engineer** – Oversees structural logic and load capacity

  o **Researcher** – Gathers cultural inspirations and inclusive design principles

  o **Storyteller** – Links design to cultural or personal narratives

  o **Presenter** – Leads the final presentation and reflection

- **Set Up Equipment and Digital Tools**

Provide each team with printed or digital copies of:

- The Bridge Design Brief
- Inclusive Design Checklist
- Bridge Structure Visual Guide
- Profiles of Women in Engineering

Then, ensure all devices (laptops/tablets) have working access to **SketchUp or Tinkercad**.

- **Review Prior Concepts and Global Relevance**

To connect the activity with real-world implications present an overview of global bridge designs using a slide deck and show a short video: *"How Inclusive Infrastructure Impacts Society"* to prompt reflection on design and equity.

- **Prompt questions to guide reflection:**

- Who is often left out of infrastructure design?
- How can a bridge reflect both utility and identity?
- What would an inclusive and empowering structure look like?

RESECH

👁 Have a look at these resources

Why This Matters – Context & Relevance

Bridges may seem like just technical structures, but they are far more than that. They are symbols of connection, both physically and socially. When cities design bridges, they decide who gets access, whose heritage is visible, and whose needs are prioritized.

This activity is not just about engineering—it's about empowering students to think critically about the kind of world they want to build. By asking students to design bridges with equity, culture, and inclusion in mind, we're giving them tools to solve real-world challenges through creative and socially aware engineering.

Students will explore how infrastructure can either include or exclude people depending on their physical abilities, cultural background, or socio-economic status. They'll also explore how women's contributions to engineering have been historically overlooked—and how representation can inspire the next generation of engineers.

This is engineering with a purpose: designing structures that reflect the values of a more just and diverse society. Furthermore:

- **Representation matters:** Research consistently shows that when students—especially girls— see role models in STEM, they're more likely to envision themselves in those roles. Including stories of women in engineering boosts confidence, interest, and long-term engagement. *Source*: UNESCO, "Cracking the Code: Girls' and Women's Education in STEM**"**

- **Inclusive infrastructure = social equity:** Studies on urban development show that designs that

prioritize accessibility (e.g., ramps, clear signage, symbolic architecture) lead to better public health, community use, and civic pride. *Source*: UN-Habitat, "Planning Inclusive Cities"

- **Culture + engineering = deeper learning:** Integrating cultural narratives and identity into STEM projects helps students develop empathy, critical thinking, and ownership of their learning. Cultural design fosters innovation because students move beyond technical problem-solving into social storytelling. *Source*: International Journal of STEM Education, "Culturally Responsive Engineering Education"

CREATE

Some things you need before beginning

Now, follow these steps

Step 1. Form Your Team and Assign Roles

Work in teams of 4–5 students. Each member takes on a rotating role to ensure everyone participates and leads at different stages:

- **Designer** – sketches the layout and ensures aesthetic elements
- **Engineer** – ensures structural stability and load-bearing logic
- **Researcher** – gathers inspiration from global bridges and cultural elements
- **Storyteller** – connects the design to a cultural or personal narrative
- **Presenter** – leads the final presentation and explains the design choices

Everyone should read a biography of a female engineer from the provided profile sheets and bring 1 inspiring idea from her story into the design.

Step 2. Explore Real-World Examples

Using printed and digital resources, dive into examples of bridges from around the world:

- Traditional (e.g., Inca rope bridges, Roman aqueducts)
- Modern (e.g., cable-stayed, suspension)
- Symbolic or community bridges

After, reflect: What materials did they use? What did the design say about the culture? What can we borrow for inspiration?

Step 3. Define the Problem Together

Your team is tasked with designing a bridge for a fictional urban space (e.g., a park or town divided by a river or highway).

*Requirements***:**

→ The bridge must be safe, functional, and culturally inclusive

→ Include accessible features like ramps or tactile paths

→ Include at least one symbolic design element (color, pattern, shape) that reflects cultural heritage or social values

Use the Inclusive Design Checklist to plan your key features!

Step 4. Choose Your Tools and Build the Prototype

Choose between two ways to build your bridge:

- **Option A**: Create a physical model using materials like cardboard, wood sticks, string, glue

- **Option B**: Create a digital model using SketchUp or Tinkercad

Include:

- Clear structure and supports

- Symbolic or aesthetic elements

- Space for safe pedestrian access (think about ramps, visibility, balance)

💡 BONUS: Include a plaque or small feature that honors a female or gender-diverse engineer from your biography reading.

Step 5. Test and Evaluate Your Design

Put your design to the test!

- Physical models: add small weights to check how much it holds

- Digital models: simulate spans and load in SketchUp, or compare with real-world designs

Use the Bridge Design Impact Checklist to evaluate:

a. Functionality

b. Aesthetic/cultural value

c. Inclusivity

d. Teamwork and role participation

Step 6. Final Presentation
Each team presents its bridge:

- Showcase your prototype (physical or digital)

- Explain your design inspiration (cultural, technical, inclusive)

- Highlight the tribute to the woman in engineering

- Reflect on your teamwork, role rotation, and inclusive leadership

COMMUNICATE

Your bridge is more than just a model—it tells a story of equity, culture, and innovation. Now it's time to share your message with others!

Present to Your Class or School
- Use a **projector** or **browser** to showcase your physical or digital bridge.
- Each team member should **explain their role** and how they contributed.
- Discuss:
  - What makes your bridge **inclusive and accessible**?
  - What inspired your **cultural or symbolic elements**?
  - How does your design promote **social impact**?

It is time to share!

Use the hashtag #BridgingTheFuture and share your creation with the world! You can upload:

- Photos of your model

- Digital screenshots (from SketchUp or Tinkercad)

- Short videos explaining your bridge

- Tributes to the female engineers who inspired you

You can upload them to the following apps:

➢ LinkedIn: https://www.linkedin.com/company/steambrace-project/posts/?feedView=all

➢ Instagram: https://www.instagram.com/steambrace_eu/

➢ X: https://www.instagram.com/steambrace_eu/

KEEP ON LEARNING

How can I make a similar project by myself?

- What part of designing your bridge challenged you the most—and how did you work through it?
- Which design element (structure, decoration, or tribute) are you most proud of—and why?
- What did you learn from researching real bridges and their cultural symbolism?
- Did the story of a female engineer or designer change how you see engineering careers?
- How did using tools like Tinkercad or SketchUp shape your creativity? Would you use them

again?

- If you were building a bridge in your own community, what problem would it help solve?

- What steps did you take to make your bridge inclusive—and how could you go further?

- If someone with mobility or sensory challenges used your bridge, how would their experience be?

- If you had more time, what new features or creative materials would you have added?

- How could you apply what you learned about inclusive and cultural design to other spaces (parks, schools, websites)?

- If you had to create another project about equity (like housing, public transport, or health), what would it be—and why?

- How does this project change the way you look at public spaces in your neighborhood or city?

Which are other connected projects?

Looking for your next big idea? Here are some projects that build on the skills, values, and creativity from your bridge design activity:

- **Design Your Community Bridge**

Choose a place in your neighborhood (a park, playground, or street) that could benefit from a small pedestrian bridge or connector.

Sketch or model your solution using recycled materials or digital tools like Tinkercad or SketchUp.

Think about:

- o Who would use this bridge?

- o What cultural or symbolic elements would you include?

- o How would it help people feel welcome, safe, and represented?

- **Create a Mini-Bridge Challenge for Your Family or Friends**

- o Turn your living room or backyard into a STEAM lab!

- o Set a goal (e.g., span 50 cm using only paper and string) and involve others.

- o Add a twist: Your bridge must represent something from your heritage.

- **Design a Sustainable Park**

- o Create a layout for a public park that is accessible to all ages and abilities.

- o Include ramps, sensory-friendly areas, solar-powered lights, and community art.

- o Use tools like Tinkercad, Canva, or even Minecraft Education Edition.

- **Redesign Your School Entrance**

- o Does your school entrance reflect safety, inclusion, and accessibility?

- o Create a new plan with better signage, ramps, welcome symbols, or eco-friendly design.

o Interview classmates or staff to understand diverse needs.

- **Build a Better Bike Path**

o Research local bike paths or pedestrian routes that need improvement.

o Design a safer, inclusive route with features like tactile paving, cultural murals, or solar lighting.

o Present your idea to local leaders or at a community STEM night.

💡 LINKS FOR FURTHER INFORMATION

Engineering & Bridge Design

- [TryEngineering: Build a Bridge Activity](#)
- [SketchUp for Education](#)
- [Tinkercad Tutorials (by Autodesk)](#)

Inclusive & Culturally Responsive Design

- [Inclusive Design Toolkit (University of Cambridge)](#)
- [Design Justice Network Principles](#)

Women in STEM & Engineering

- [UNESCO: Women in Science Stories](#)
- [She Can STEM – Real Role Models](#)

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