

ACTIVITY

Building the Road to Clean Water

OBJECTIVES

Students will:

- **Perform** research to deconstruct and better understand the global water problem.
- **Design** a creative and empathetic solution to the global water problem.
- **Develop** a realistic plan to influence change or inspire action in their community connected to the overall problem.

GRADE RANGE

5–9

DURATION

One class session (approximately 45–60 minutes)

OVERVIEW

Of the 7.9 billion people on our planet, 2.2 billion people still lack access to safe drinking water.¹ In this lesson, students will investigate this global water problem and learn about Caminos de Agua—an organization that believes that access to safe, healthy drinking water should be a fundamental human right and aims to improve human health and community well-being through adequate and affordable access to clean water.

To better understand the problem and empathize with those whom the problem affects, students will first research the global water crisis and the UN's Sustainable Development Goal of every person on the planet having clean water and sanitation by 2030. Then, using design thinking, they will tackle the problem to develop technological innovations that could positively help those affected. At the end of the lesson, students consider how they can inspire their own community to learn more about the problem, empathize with those in need, and perform an action that contributes to positive change. They will create a brief plan that details how they could influence this change and take action in their own community.

¹ <https://sdgs.un.org/goals/goal6>

MATERIALS

- Internet device with ability to project video, one per educator
- Device with internet access, one per group
- **The Water Problem WebQuest** student handout, one per group
- **Finding Solutions** student handout, one per group

PROCEDURE

Engage

1. Begin the session by explaining to students that they will be learning about water scarcity and its global effect before investigating and designing potential solutions. If necessary, explain that the word scarcity means something is in short supply, and that currently around the world, 2.2 billion people still lack access to safe drinking water.²
2. Divide students into groups of three or four and distribute one **The Water Problem WebQuest** handout to each group. Instruct groups to use the website provided and a search engine to investigate the problem they will be working on.
3. Students will be researching the global problem as well as local water sources and constraints in their own community. If students have trouble answering #6, provide a national example, such as the infrastructure-related water crisis in Flint, MI, the push for rainwater capture in Arizona, or the environmental challenges affecting the Colorado River.
4. After approximately 10–15 minutes, provide students with the opportunity to ask questions, provide insights, or share their causes and effects. Use these contributions as a springboard to learn about solution initiatives such as Caminos de Agua, which is featured in the video you will show next.

Learn

5. Play the *Problem Solvers for Good: Making the World a Better Place Through Engineering* video featuring Caminos de Agua. (<https://engineeringdreamsinschool.com/educators/video-topic-series/>)
6. Explain that now that they understand the problem, it is important to understand current solutions before exploring potential new solutions. Distribute a **Finding Solutions** handout to each group.
7. Give groups approximately 10 minutes to record information for part one of the handout.

² <https://sdgs.un.org/goals/goal6>

- Review student responses and use this time to clear up any misconceptions, answer questions, or add information before students move on to designing their own potential solution.

Apply

- Direct students' attention to part two of the handout. Explain that to create a meaningful and effective solution to a problem, it is important to empathize and understand the point of view of those experiencing it. Provide groups two or three minutes to jot their ideas down for the first question.
- Explain to students that the ideation process is part of the engineering design process that comes after empathizing and defining your problem. It is when you think of changes that can be made, new ideas that can be implemented, and brainstorm potential solutions to your problem. Ideation plainly means the creation of ideas. Instruct groups to record their ideas for the second question of part two. Provide groups with 5–10 minutes to ideate.

Challenge

- The students' final step is to design. Instruct them to take a few moments to discuss their ideation notes and decide on a solution to try. Remind them that the engineering design process is represented as a circle because it often takes more than one idea and more than one try to get to the solution!
- When groups are ready to design, direct them to complete part three of the **Finding Solutions** handout.

Reflect

- Facilitate students' reflection on their learning during this session by inviting them to summarize the water problem and what is currently being done to address it.
- If time allows, ask volunteers to share their unique design ideas with the class so peers can provide both positive and constructive feedback on the designs as part of the engineering design process.

LEARNING EXTENSIONS

- Provide students time to build a prototype of their initial design. Working through the ideation process, have them record successes and failures and make improvements to their designs.
- Guide student in a service-learning project in which they create a solution to the water problem that they can implement either in their community or with the help of their community. Lead students as they “take to the streets” to test the success of their idea(s).

NATIONAL CONTENT STANDARDS

Next Generation Science Standards

Engineering Design:

- 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-ESS3-1: Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
- MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Standards for Technological Literacy (ITEEA Standards)

Standard 1: Students will develop an understanding of the characteristics and scope of technology. In order to comprehend the scope of technology, students should learn that:

- F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.
- G. The development of technology is a human activity and is the result of individual or collective needs and the ability to be creative.

Standard 4: Students will develop an understanding of the cultural, social, economic and political effects of technology. In order to recognize the changes in society caused by the use of technology, students should learn that:

- D. The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.

Standard 8: Students will develop an understanding of the attributes of design. In order to comprehend the attributes of design, students should learn that:

- E. Design is a creative planning process that leads to useful products and systems.
- G. Requirements for a design are made up of criteria and constraints.

COMMON CORE ENGLISH LANGUAGE ARTS STANDARDS

Reading:

- R.7: Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

Writing:

- W.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- W.7: Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

Speaking & Listening:

- SL.1: 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.

1. Visit <https://sdgs.un.org/goals> and record important facts you can find regarding the global water problem:

2. What is the United Nation’s plan to address this global crisis?

3. Use a web browser to discover three different causes of water scarcity around the world. What is the effect on the people who experience them?

Causes of Water Scarcity	Effects on Humans

4. Do you know where your drinking water comes from? Do a little research to find out:

5. How do you know that your drinking water is clean and safe? What safeguards are in place to make sure?

6. Is there an instance of water scarcity near your community? If so, what is being done to address it? If not, research someplace in the United States that struggles to have clean and safe drinking water readily available.

Part 1: Aquadapt

One existing solution you learned about during the video is Aquadapt. By using the information from the video and exploring <https://caminosdeagua.org/> and search engines, answer the following questions to better understand current solutions to the water problem.

1. Explain the problem that Caminos de Agua and Aquadapt is trying to solve.
2. How does Aquadapt work to solve this problem?
3. What other organizations or products are trying to solve the water problem in a similar way?

Part 2: Empathize, Define, and Ideate

1. Use what you learned during your research to summarize the water problem. Think about a specific population, either globally or locally, that the water problem affects and what they need.

2. In what ways could you solve this problem? Could you adapt a solution that already exists? Could you engineer a brand-new solution? There are no right or wrong answers. Many ideas could contribute to the solution!

Part 3: Design

1. In the box, illustrate a potential solution to the water problem. This could be an improvement to a product that already exists or an entirely new product. Be sure to label important parts! Continue to brainstorm on a separate piece of paper if you have more ideas.

