



TEACHER LESSONS

The Tech for Global Good: The World's Water Problem

Objectives

Students will be able to:

- Perform research to deconstruct causes and effects of the water problem.
- Design a creative and empathetic solution to the water problem.
- Develop a realistic plan to influence tangible change connected to the overall problem and take action in their community.

Overview

Around the world, 785 million people have to walk over 30 minutes just to find water—and often the water they find is still unsafe to drink.¹ In this lesson, students will investigate this global water problem in alignment with a series of video clips featuring [Solvatten](#), a social enterprise whose innovative solution uses the sun's power to clean contaminated water in off-grid communities.

To better understand the problem and empathize with those whom the problem affects, students will first research the global water crisis. They will then tackle the problem using design thinking as they develop technological innovations that could positively impact those affected. The lesson will culminate as students consider how they can inspire their own community to learn more about the problem, empathize with those in need, and/or 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.

This lesson focuses on

Design Process

- Defining the Problem
- Designing Solutions

21st Century Skills

- Communication
- Collaboration
- Critical thinking
- Creativity

Grades

6–8

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Timing

180 minutes

Materials

All sessions:

- Device with the ability to project video, one for the teacher

Problem

- *Problem* video clip
- Scrap paper, one per student
- Handout 1: Research the Problem (two pages), one per student
- Devices with Internet access, at least enough for half the class

Solution & Impact

- Handout 2: Design Thinking (three pages), enough for one-quarter of the class
- Handout 3: Solution Storyboard (two pages), enough for one-quarter of the class
- Handout 4: Imagine the Impact, enough for one-quarter of the class
- *Solution and Impact* video clips

What Can I Do?

- Three pieces of chart paper, labeled “Educate,” “Empathize,” and “Act,” placed around the classroom*
- Markers, for students to share
- *What Can I Do?* video clip
- Handout 5: Create Change (two pages), one per student

*Note: Students will be visiting each of these chart papers. If you have a large class, you may use six pieces of chart paper and create doubles.

Background Information

The following section provides background on topics covered in this lesson. While it is designed for educators, this information may also be shared to supplement students’ understanding as needed, *after* the lesson’s Problem section has been completed.

Have you ever wondered...

What is the water problem?

Around the world, more than two billion people drink contaminated water—which can transmit diseases such as cholera, dysentery, typhoid, and polio. 785 million people must walk for more than 30-minutes roundtrip to get water because they don’t have it accessible at home.¹ Many people (especially women and children) are responsible for walking this distance every day. This “water walk” comes at the expense

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of going to school, working, or taking care of their families—and often the water retrieved during these walks is still not safe to drink.

Have technologies been developed to help the water problem?

The United Nations' Sustainability Goal 6: Clean Water and Sanitation is hoping to achieve “universal and equitable access to safe and affordable drinking water for all” by 2030.² To work toward this goal, a variety of technologies have been developed and are being developed to help those in need. For instance: Carnegie Mellon, in partnership with the nonprofit Water is Life, has developed a drinkable book that not only shares sanitation advice but is printed on filter paper that can be used to purify water. Another nonprofit, Dar Si Hmad, developed mesh nets to capture moisture from fog, which then drips clean water into collection trays once the fog condenses.³ Solvatten, as students will learn in this lesson, is a Swedish social enterprise that uses the power of sunlight to kill water's germs...and the list goes on. There is no one-size-fits-all solution—and governments, corporations, and communities alike must come together to create change.

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Make Connections

How does this connect to students?

Water is essential for life. About sixty percent of the human body is composed of water, and all plants and animals need it to survive. In the human body, water helps move nutrients, regulate temperature, and flush waste. Humans need about eight cups of water a day, and about one-fifth of this total can be obtained through the food we eat. People who don't drink enough water become dehydrated, and people who drink unclean water risk sickness.⁴

Despite the necessity of water, 1.4 million Americans live in homes that lack access to hot and cold running water, and they are joined by hundreds of millions more around the world.⁵ While water is a resource that students may take for granted, it's crucial for them to be aware of the importance of water and the water scarcity many face.

How does this connect to careers?

Environmental Engineer: Environmental engineers work to improve recycling, waste disposal, and water and air pollution control. They help design systems that provide clean water to communities and dispose of waste safely.

Hydrologist: Hydrologists research the properties and distribution of surface water and underground water, as well as its effects on public health. In communities with water shortages, they help develop plans to improve access to clean water.

Civil Engineer: These engineers are responsible for designing water infrastructure in communities around the world. They can help meet the needs of people in developing countries by designing systems that increase access to clean drinking water.

How does this connect to our world?

When water is not accessible in one's home, the burden of the water walk (i.e. the walk to find water) usually falls on women and children. This daily walk, which is often more than 30 minutes in length and sometimes must be completed multiple times a day, takes valuable time away from school, work, play, and family care. When water is more accessible and less time is needed to collect water, school attendance tends to increase and women have more time to make money and/or care for their families.⁶

Access to clean water is not only necessary for basic health and survival, but it's needed for food production, socio-economic development, and healthy ecosystems. By 2030, the United Nations' Sustainability Goal 6: Clean Water and Sanitation is hoping to achieve "universal and equitable access to safe and affordable drinking water for all"² and a series of specific targets outline how the United Nations is measuring progress toward this goal.

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Sources:

1. "Drinking Water." World Health Organization. who.int/news-room/fact-sheets/detail/drinking-water.
2. "Goal 6: Clean Water and Sanitation." United Nations Environment Programme. unenvironment.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-6.
3. "Could these five innovations help solve the water crisis?" The Guardian. theguardian.com/global-development-professionals-network/2017/feb/13/global-water-crisis-innovation-solution.
4. "How Water Works." HowStuffWorks. science.howstuffworks.com/environmental/earth/geophysics/h2o3.htm.
5. "More than 2 Million Americans Living Without Clean Water, New Report Shows." Newsweek. newsweek.com/more-2-million-americans-living-without-clean-water-report-shows-1472500.
6. "The Water Crisis." Water.org. water.org/our-impact/water-crisis/.

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Blueprint for Discovery

PROBLEM: 50 minutes

1. Begin class by challenging students to consider how many times a day they use water. Distribute scrap paper and ask students to jot the ways in which they use water from the time they wake up in the morning to the moment they go to sleep. Then prompt each student to count the instances that they brainstormed and share the total. (5 minutes)
2. Ask students to discuss: Do you think this number is similar in countries around the world? Why or why not? (5 minutes)
3. Encourage students to keep this question in mind as you show The Problem video segment. When the video is complete, ask: By a show of hands, whose opinion changed about whether countries around the world use water similarly? Whose opinion remained the same? Why? (5 minutes)
4. Lead the class in a full-group discussion around the following questions:
 - If they wanted to, do you think people who live in regions like those you saw in the video could use water as often as you do? Why or why not?
 - What challenges prevent them from using water as often as you do?
 - Other than health, how else does this lack of access to clean water affect people?
 - How might your life be different if you lived this way? How would you feel? (10 minutes)
5. Explain that before they try to develop a solution to this problem, as the video clip challenged them to, they will conduct Internet research to deepen their understanding of the issue.
6. Divide students into pairs, and pass out one copy of Handout 1: Research the Problem to each student. Each pair will also need a device. Explain that students will follow the step-by-step directions on the handout in order to complete research on the problem. (20 minutes)
7. When their research is complete, pair partners together to form groups of four. (Try to combine pairs who researched different countries.) Give groups about five minutes to briefly describe their country's land and climate, in addition to the notes they recorded in the chart for #5. Encourage pairs to consider what they can learn from each other and add new notes to their charts.

SOLUTION & IMPACT: 70 minutes

1. Now that students have a deeper understanding of the problem, explain that they are ready to tackle the question that the video clip presented: How would you solve this problem?
2. Distribute one copy of Handout 2: Design Thinking to each group of four. Review the handout's directions and explain that students will be collaborating to brainstorm solutions to the water problem.* Students should be creative as they ideate. If technology is part of their solution, they don't need to know if their tech functionality is currently possible as long as it could potentially help solve the problem. (15 minutes)

*Note: Students may choose to ideate solutions specifically for one of the countries that they researched or for the problem at large.

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- Distribute one copy of Handout 3: Solution Storyboard and Handout 4: Imagine the Impact to each group.

First, review the instructions on Handout 3 and explain that the next step in the design process will be to select one solution that they think will have the largest positive impact on people affected by the water crisis.

Then review Handout 4's instructions, and reiterate the importance of designing a solution that has the user and the user's needs in mind. If needed, walk through the handout's layout and the way in which it demonstrates a solution's ripple effects. For instance: Access to clean water leads to more free time in one's day, which could lead to having time to go to school, which could lead to graduating from high school, etc.

Allow groups about 30 minutes to work.

- Bring the class back together to show the *Solution* and *Impact* video segments. Instruct students to think about how their solution and impact compares to the solution presented as they watch. (5 minutes)
- When the video viewing is complete, ask each group to compare and contrast the actual solution and impact with their own ideas, and challenge them to optimize their own solution in at least one way. Give groups about 10 minutes to make edits directly to their storyboard.
- For the time remaining in the session, conclude with a full-class discussion around the following questions:
 - What changes did you make to your solution based on what you just viewed? Why?
 - What would be impacted if more or all people had easy access to clean/uncontaminated water?
 - In order for tech to be used for good and help solve a problem like this one, who needs to be considered? Who needs to be involved? Why is it important to think about governments, corporations, and community members when developing solutions?

WHAT CAN I DO?: 60 minutes

Instructor Prep: Before this class session, place the *Educate*, *Empathize*, and *Act* chart papers around the classroom. See the Materials section for more details.

- Begin this session by bringing students' attention to the *Educate*, *Empathize*, and *Act* chart papers. Explain (or—if one or more of the other Tech for Global Good lessons has already been completed—review) that these are three different steps that they, as students, can take to help create change. Today, students will consider how these steps could affect local change related to the water problem. As you point to each chart paper, encourage students to think about:
 - Educate:** How can you help others learn more about the water problem in order to better understand why people don't have access to clean water?

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- Empathize: How can you help others understand what it's like to be someone affected by the water problem?
 - Act: What actions could you and other students take to make a difference and contribute toward solving the water problem? (5 minutes)
- 2. Explain that, in a moment, student pairs (from the original activity) will walk quietly around the room and write on each piece of chart paper—either contributing a new idea or elaborating on an idea that a peer has already added. (10 minutes)
- 3. Once every pair has read and contributed to the *Educate*, *Empathize* and *Act* chart papers, review what the class has brainstormed. (5 minutes)
- 4. Then show the *What Can I Do?* video segment. As students watch, encourage them to listen for additional ideas that can be added to these three categories, and add these ideas when the clip is complete. (5 minutes)
- 5. Challenge students to consider what they can personally do now to help the water problem. Distribute one Handout 5: Create Change to each student, and review the step-by-step directions. Reiterate that individual students or pairs will select one way they can take action in their own community and will create a plan for carrying it out. As they develop their plan, they should consider if it could be strengthened by including technology* that already exists. If so, they should incorporate this technology into their action plan. (20 minutes)

*If your students would benefit from technology suggestions, you may share the list below. Alternatively, students could also perform their own Internet research to find tech resources or products that align with their change idea.

- Educate:
 - Informative websites about the water crisis: [United Nations](#), [World Wildlife Fund](#)
 - Online news sources: [Newsela](#), [The Learning Network](#)
 - Videos: [United Nations](#), or keyword searches on [Vimeo](#) or [YouTube](#)
- Empathize:
 - The *Educate* websites from above can be used to help put yourself in the shoes of someone affected by the water crisis.
 - Create a Water Walk Route with [Google Maps](#), [Plot a Route](#), or [Map My Walk](#)
 - Track steps with a free step tracker, such as Apple's free [Health App](#) or one of Android's [pedometer apps](#)
- Act:
 - Use a relevant social media platform(s) to create a targeted campaign
 - Create a presentation for a target audience that promotes a specific action using [PowerPoint](#), [Google Slides](#), [Prezi](#), [iMovie](#), etc.
 - Raise money for a water project such as [Solvatten](#), [The Water Project](#), [World Vision](#), or others.

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- Research careers that could positively influence the water problem and inspire others to consider these career paths.
6. Allow about 15 minutes at the end of the class session for students to present their ideas to each other. Each student or student pair should share the action they have selected, why this change is important, and the first step they will take toward achieving it! As students listen to their peers' ideas, remind them of the importance of working together to create change. At the end of the presentations, tell them they will be expected to share how they could collaborate with one of the other groups to make an even greater impact.

National 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.

Earth and Human Activity:

- 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.

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.

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.

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- 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.

Standard 11: Students will develop abilities to apply the design process. As part of learning how to apply design processes, student should be able to:


- H: Apply a design process to solve problems in and beyond the laboratory-classroom.
- J: Make two-dimensional and three-dimensional representations of the designed solution

1. Visit thewaterproject.org/research-center. Browse the information on the webpage, and then select one country in the “Water Crisis Spotlight” column on which to focus.

Our Focus Country is: _____

2. Before you read about this country’s water problem, learn more about the country as a whole. Go to maps.google.com, and click and drag the map until you locate your country.

Then click on the Satellite View square in the bottom left corner of the Google Maps page. What do you notice about this country’s land? Record your notes below.

3. Next, use the “+” button in the bottom right corner of the screen to zoom into your country. Once your country’s land takes up most of the screen, click the three squares below the zoom that look like this: 

This will bring up photographs of your country. Browse the photos and jot observations about the country’s land and/or living conditions below:

4. Learn more about the climate of your country. Visit weather-and-climate.com, find your country, and record key details below:

5. Then return to thewaterproject.org/research-center. Now that you have a better understanding of your country's land and climate, read to learn more about the water problem and how it affects the people who live there. As you do, fill in the chart below:

What is causing or contributing to the water problem in this country?	How does this problem affect the people who live there?

Empathize & Define

Use what you learned during your research to summarize the water problem. Think about *who* the water problem affects and *what* they need.

Ideate

In order to solve this problem, what change(s) would have to occur? There is no right or wrong answer. Many different changes could contribute toward a solution!

Sketch: In the following boxes, illustrate two potential solutions that could achieve these changes. Try to develop at least one solution that uses some form of technology. This could be an improvement to a product that already exists or an entirely new tech product.

Be sure to label important parts! Continue to brainstorm on a separate piece of paper if you have more than two ideas.

Solution A:

Solution B:



Solution Storyboard, page 1 of 2

STUDENT HANDOUT 3

Directions: Use this storyboard to explain how your innovation could be used to help people affected by the water problem. Clearly show *how* your solution could be used to help solve this problem, as well as *who* this solution would affect. Each square should show one step, and the end result should be illustrated in the final square. You may use as many squares as needed.

Remember to consider people's needs and make your solution as user-friendly as possible!

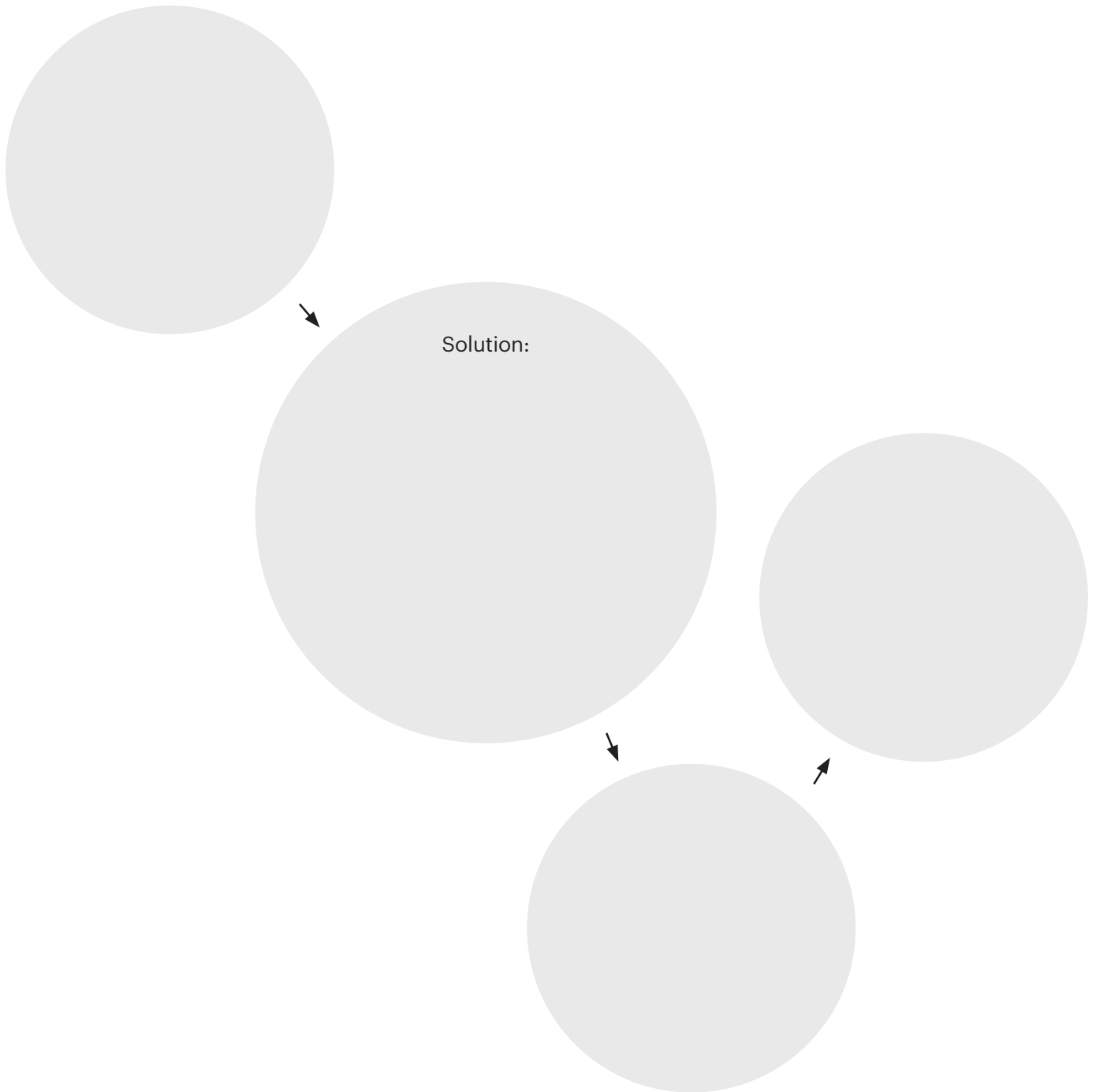
1	2	3
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4	5	6
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Imagine the Impact

A solution to a large problem can have a ripple effect: It not only solves the problem at hand, but can positively affect people's lives in many other ways as well.

Fill in the diagram below as you consider the many effects of your water solution. Use the circles provided as a starting point, and then continue to add your own!



Select one action you can take in your community that will help the water problem. This action may fall into the *Educate*, *Empathize*, or *Act* categories. It may be an idea from the video, one that you or your classmates developed, or an entirely new idea.

I will create change by inspiring my community to:

Then explain: Why is this action important? How will it help the water problem?

Step 2: Create a Plan

Break your idea into at least three smaller steps. As you do, try to include an existing tech resource or innovation to help accomplish your goal.

1.

2.

3.

4.

Step 3: Begin!

Now that you have a plan in place, get started on your first step and begin creating change.