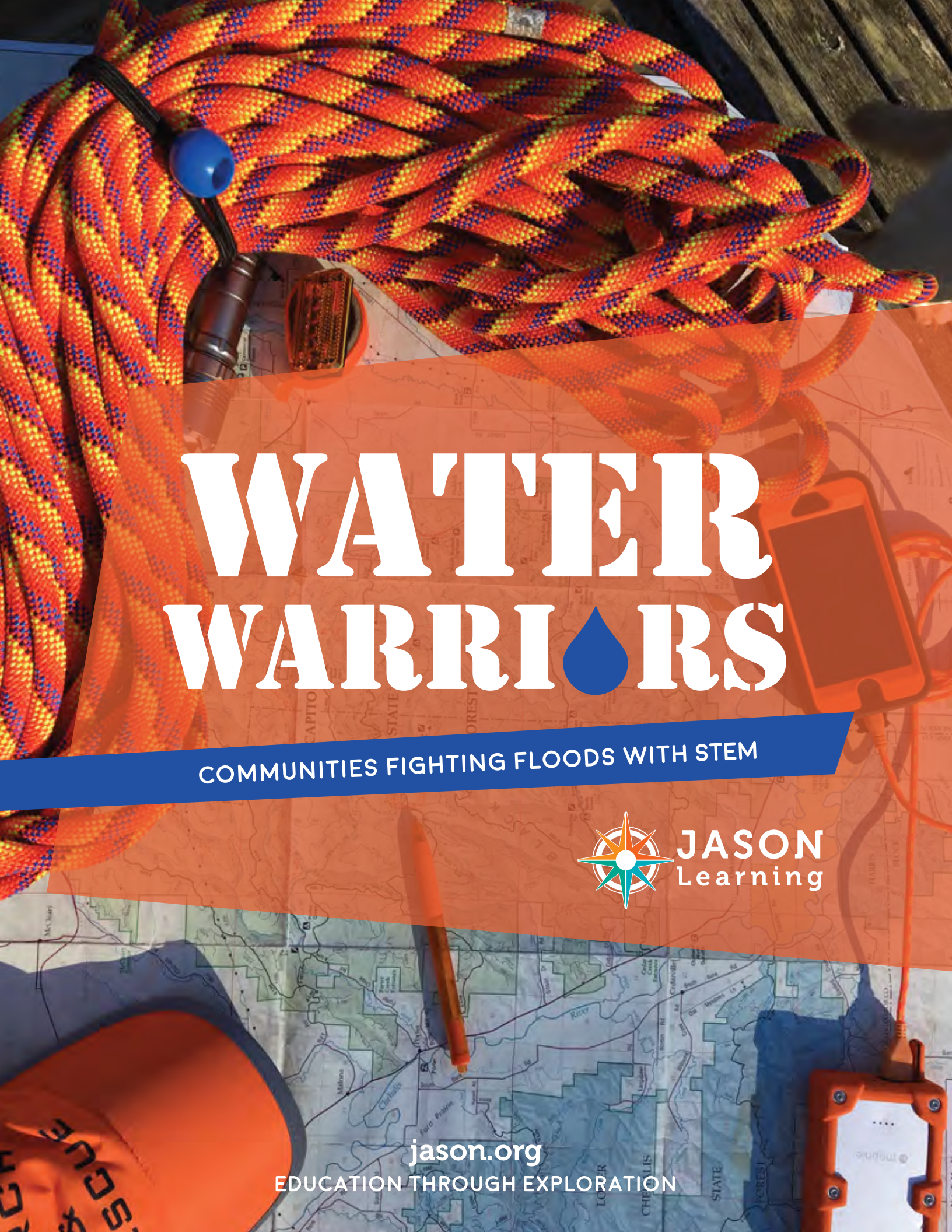

WATER WARRIORS

COMMUNITIES FIGHTING FLOODS WITH STEM

JASON Learning

jason.org

EDUCATION THROUGH EXPLORATION

EDUCATORS EDITION

In the **Water Warriors Design Thinking challenge,** middle and high school students imagine and prototype flood barriers that can protect their community from flooding. Teams can tackle this challenge using a wide-range of materials and technology, from everyday materials available in the classroom to 3D printed components. The focus is on the ideas and approaches, not the products.

Through this challenge, students will:

- Acquire deep understanding of the challenge posed by flooding
- Build and apply foundational and advanced STEM knowledge and skills, cutting across many disciplines, from earth science to physics to computer science and engineering
- Build important career skills, such as problem solving and design thinking, teamwork, entrepreneurship, and communication, and develop a supportive network of peers, educators, and career mentors / advocates
- Grow in confidence, think creatively and engage deeply with their community and possible careers
- Translate their new-found strengths into innovation, local impacts and jobs

Students can earn a **Water Warriors Design Thinking badge** by submitting a description of their flood barrier prototype and its capabilities, supported by photographs or a short (1-minute maximum) video.

The **Water Warriors Design Thinking challenge** also offers an opportunity for elementary grade students to identify people in the community who help others in natural disasters and come up with ways they could help people in their community recover from these events.

Day of Design Challenges encourage students to create like an innovator by employing creative problem-solving skills and an entrepreneurial mindset while innovating a solution to a problem.

Design Thinking is a widely-used methodology that seeks to create solutions for the future, rather than solving problems that have occurred in the past. It is focused on achieving the best possible outcome for the end user, who could be a person, an organization or even a community. It draws on logic, imagination, intuition, knowledge and reasoning to explore, design and test possible solutions. It provides an engaging and meaningful connection between learning in the STEM classroom and the world beyond it.

A fun and easy way to introduce students to design thinking is to run the "Wallet Project" from the Institute of Design at Stanford University:

https://drive.google.com/open?id=0B5AACdnRM_mUMVdLSWlZN2NQZmM

We have just experienced how devastating floods can be. They can put lives in jeopardy, destroy property, and displace people. However, we are not powerless against floods. We can apply ideas from science, technology, engineering, and math (STEM) to solve problems related to flooding. Scientists can monitor the strength and paths of major storms to warn the people in their paths. Engineers can design buildings and even cities to help prevent major flood damage. We can use technology to coordinate relief and rescue efforts after a major storm.

Scientists and engineers are always working to design better solutions for areas that are in danger of flooding. These are complex problems, and they require complex thinking. Design thinking is a powerful way to develop solutions to complex problems. It starts with defining the problem and understanding how that problem affects people. Then it requires brainstorming many, many ideas and designing and testing prototypes of those ideas. In this type of design, failure is just part of the process. There is room for improvement in every design.

There is much we can already do to help lessen the effects of major storms. But there is also much more we could do. And that is where you come in. By applying your understanding of STEM skills and knowledge and by using design thinking, you can come up with new and innovative solutions to the many problems caused by storms and flooding.

*Your **Day of Design Water Warriors Challenge** is to design a solution that will protect a small house from flooding.*

PART 1. IMAGINE A SOLUTION

STEP 1. Imagine an "Ideal" Solution

Talk to your team. What do you think the "perfect" solution is to protect a small house from flooding?
Sketch your idea here:

STEP 2. Dig Into The Problem

Teacher Tips and Resources:

To jumpstart your students' research you can direct them to some of the following links and JASON Learning curricular resources.

NOAA Severe Weather 101. Flooding webpage: http://bit.ly/2wBEAT0

NOAA storm surge video: http://bit.ly/2xhAcZ5

Examples of home-made and commercial personal flood barrier solutions:

- 25+ flood barrier designs: https://www.pinterest.com/explore/flood-barrier/
- Aqua Dam: http://bit.ly/2wJQrtf
- Flood Gate: http://bit.ly/2hm2qrF
- Flood Shield: http://bit.ly/2fcZkVZ

Connections to JASON Curricula and supporting investigations:

Monster Storms: Exploring the powerful forces of weather

- For understanding how a storm forms - Mission 1: Profiling the Suspects & Mission 2: The Plot Condenses
- Hurricanes - Mission 4: The Hunt-Flying into the Eye
- For risk assessment, emergency response, & remediation - Mission 5: the Recovery-Living with Monster Storms

Suggested Investigations

- Mission 5
  - Lab 1 - Risk Assessment
  - Lab 2 - Storm Surge (use profiles of Houston instead of New Orleans)
  - Lab 3 - Field Assignment: Build a Better Building

Now do your research on the problem of flooding. And, if possible, interview someone who owns a small house, or who is responsible to manage flooding in your community. These are your "users".

What do they currently do for flood protection?
Capture what you learn here:

Why does this work or why does it not work?
Capture what you learn here:

What does their "ideal" solution for flood protection look like?
Sketch it here:

What is stopping them from making or using their "ideal" solution? Is it money, rules, lack of technology or materials?
Capture what you learn here:

What were the key findings from your research?
Capture what you learn here:

What features of your "ideal" solution do you think will work and which won't? Why?
Capture what you think here:

STEP 3. Create Alternatives to Test

Imagine at least 3 different ways to meet your "users" needs. Make sure that each is as different as possible from the next.
Sketch your 3 or more ideas here:

Ask your "users" or other teams in your classroom what they think of your ideas.
Capture what you learn here:

PART 2. PROTOTYPE YOUR SOLUTION

STEP 1. Reimagine Your "Ideal" Solution

Teacher Tips and Resources:

Start by getting your students to discuss what materials they think should be part of their flood barrier and why? Ask them to define the attributes of these materials that are important and why, as well as their advantages and disadvantages.

Possible answers might include:

- Plastic - because it is waterproof, light but solid. But it can be hard to make into a specific shape without specialized tools.
- Sand - because it is heavy, usually easily available and can be used to make a wall. But it needs to be "held" together because it can be washed away by water (e.g. in a waterproof bag).
- Cement - because it is heavy and waterproof. But it is hard to obtain and to work with.

Now that their designs are becoming more "realistic", they should also think about some of the key factors that limit whether people will be able to make, use or afford them, for example zoning laws and finances.

Based on all the insights you have gained, what do you NOW think a workable solution is to protect a small house from flooding?
Sketch your idea here:

STEP 2. Create a Prototype

Teacher Tips and Resources:

Start by having your students suggest classroom materials they could use for their prototypes. Ask them what they think makes the materials appropriate for the prototype - e.g. availability, ease of use? Have them consider whether the materials they want to use for their prototype model the materials they would use in a "real" flood barrier?

If time permits, ask your students to evaluate the suitability of different classroom materials by testing whether they display desirable attributes, like strength or absorbency. This optional activity lets them test absorbency, but it can be modified to test other attributes:
http://www.jason.org/waterwarriors/activity1

Using the resources available to you, create a prototype of your solution. It might not match your ideas completely. But it should help bring your ideas to life for your users, and allow you to start testing them.

Describe how you will create your prototype here:

STEP 3. Test Your Prototype

Teacher Tips and Resources:

Discuss with your students they can test their prototype in the most realistic setting possible, given available materials and resources.

In this optional activity students are introduced to one possible set-up to test their flood barriers in a controlled, classroom setting: http://www.jason.org/waterwarriors/activity2

Using the resources available to you, test your prototype. If possible, ask your "users" what they think.

Describe how you will test your prototype here:

Capture what you learn here:

STEP 4. (OPTIONAL). Refine Your Prototype

Teacher Tips and Resources:

If your students don't have time to iterate on their flood barrier prototypes, have them describe what they would change based on their test.

If you have the time and the resources, use what you have learned by testing your prototype and improve your solution. You can do this once, twice, or as many times as possible.

PART 3. SHARE YOUR SOLUTION

STEP 1. Reimagine Your "Ideal" Solution

Now it's time to tell your users and your community about your solution. Using the resources available to you, create a digital presentation (with pictures if possible) or a short (1-minute video) that describes your solution, how it works, and anything you have learned about it. Don't be afraid to share ideas or designs that didn't work. These are important because they tell you what the tough challenges are and help you make better solutions for the future

*Ask your teacher to upload your presentation / video to the **Day of Design** so that you can get your **Water Warriors Design Thinking BADGE.***

Teacher Tips and Resources:

Find instructions on how to get your Day of Design BADGE at http://www.jason.org/waterwarriors

How can you bring your prototype / solution to your community? What do you need to make this happen? Who could you work with? Are there other opportunities to help your community prepare or mitigate from flooding risks? Be creative, get involved! Then create and share a video to tell the story of your adventure as a Water Warrior.