Figure 6.6: Disaster-Resilient Housing Project Plan Summary

Challenge: Disaster-resilient housing	
Primary SDG Focus: **SDG 11**—Sustainable Cities and Communities	**Secondary SDG Focus:** **SDG 13**—Climate Action **SDG 9**—Industry, Innovation, and Infrastructure
Science Content: • Forces and structures • Natural hazards and natural disasters • Global warming • Fluid mechanics (flooding and wind resilience) • Wave mechanics (earthquake resilience) • Plate tectonics (earthquake and tsunami resilience)	**Country Focus:** • Option one—Students choose a location that has endured a natural disaster in the past ten years. They should match their solution to the type of disaster in that region. • Option two—The teacher specifies what type of disaster students design solutions for and groups select a location accordingly. • Option three—The teacher assigns a specific location to each group.
Overall Sequence (Estimate: fifteen classes)	
1. Introduce the SDGs generally.	Give students a broad overview if SDGs are unfamiliar; highlight resources on the United Nations' website (https://sustainabledevelopment.un.org/sdgs) and the World's Largest Lesson (http://worldslargestlesson.globalgoals.org).
2. Give an overview of AT.	See the resources on page 168; I recommend the video "Lucky Iron Fish" (www.youtube.com/watch?v=iY0D-PIcgB4) as an example of AT in general.
3. Introduce issues related to housing and SDG 11.	Visit UN's World's Largest Lesson website (https://bit.ly/2njRYBC). Visit UN's Sustainable Development Goals Knowledge Platform website (https://sustainabledevelopment.un.org/sdg11).
4. Employ a video or TED Talks hook.	Watch "The Warmth and Wisdom of Mud Buildings" (Heringer, 2017). Other options are available online.
5. Do a quick build.	For wind, the Paper Tower of Power activity (page 96) For water, building a house prototype with simple materials, that floats and can hold pennies or stones
6. Research science concepts (background).	See the There Is Always More to Learn section (page 12) in chapter 1 and the Content section (page 62) in chapter 3; have students help identify what they need to know.

7. Choose a country.	Depending on degree of student choice, groups should conduct appropriate research and complete the form in figure 6.7 (page 169). This form is for students in grades 6–9. You may need to add or ask for more detail for students grades 10–12. It still works well as a graphic organizer at all levels.
8. Know your problem. • Clearly define the problem (where the problem exists, the extent of problem, how often the problem arises). • Identify and research end user needs. • Identify constraints, both for the prototype and for an actual solution. • Define criteria.	Much of the end user definition depends on the location. Understanding actual constraints in that location supports a focus on appropriate technology. Remind students that criteria need to reflect the lifestyle, culture, and values of the location.
9. Know your options. • Conduct any additional research about the location, types of storms or disasters, what has been tried in the location and in similar areas. • Brainstorm many options and ideas.	Encourage students to explore what has already been tried. When brainstorming, prompt groups to consider the location's culture and typical housing (that is, materials, colors, architectural features, and so on).
10. Develop a solution. • Sketch the location. • Plan building steps and create the prototype materials list. • Build the housing prototype. • Test the housing prototype. • Modify the housing prototype.	The materials used for prototyping should be chosen to represent (as closely as possible) those available for the actual solution. For instance, straws can stand in for bamboo; foam core can represent wallboard; plastic wrap can stand in for window glass, and so on. Work with students to develop a suitable test for their structure. Test houses designed to float in a sink; pour or spray water on houses designed to resist tropical downpours; create "wind" using a hair dryer, fan, or compressor to test windstorm-resilient houses; make and employ simple shake tables (instructions at https://bit.ly/2JdmQ3S) to test earthquake-resistant buildings. When designing tests, specify the procedure, number of trials, and what is considered successful. If it is impossible to make actual modifications (the building prototype collapsed or sank, for example), students should discuss possible modifications in their final summary.

11. Present the final solution.	Try using groups to present to the rest of the class, who play the role of local government officials or representatives of an international relief organization. Creating a short summary report or marketing brochure is appropriate for high school students. Videos highlighting the benefits of the housing and even showing tests are possible final deliverables.

Heringer, A. (2017). Anna Heringer: The warmth and wisdom of mud buildings *[Video file]. Accessed at https://ted.com/talks/anna_heringer_the_warmth_and_wisdom_of_mud_buildings/up-next?language=en on April 4, 2019.*