FIGURE 1: Table of Midwest and U.S. regional map (Regions of the United States 2020; for full continental U.S. data, see "natural hazards for continental U.S. states by region" in Supplemental Materials).

Region	Average tornadoes per year	Number of hurricanes per State (1851–2020)	Number of strong (>3.5) earthquakes per year (1974–2003)	Percentage of state within flood hazard area
Midwest				
Illinois	54	0	17	12.3%
Indiana	22	0	6	10.3%
Iowa	51	0	0	8.2%
Kansas	96	0	4	9.1%
Michigan	16	0	2	4.7%
Minnesota	45	0	2	7.2%
Missouri	45	0	21	15.1%
Nebraska	57	0	8	8.9%
North Dakota	32	0	0	3.4%
Ohio	19	0	8	6.9%
South Dakota	36	0	10	3.9%
Wisconsin	24	0	0	10.3%

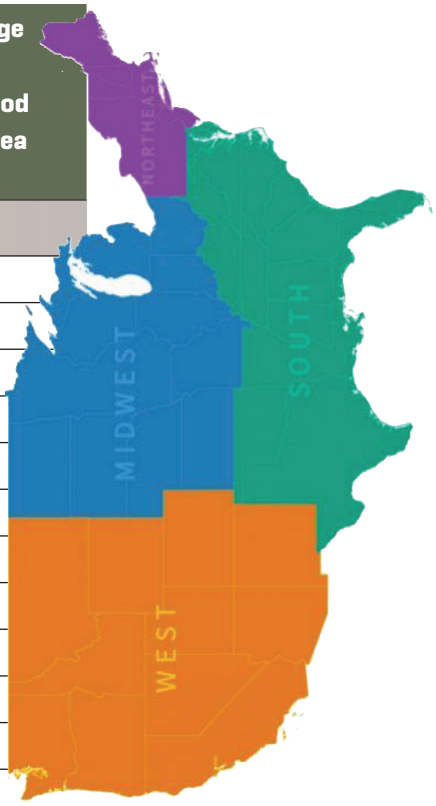

FIGURE 2: Engineering tasks and prompts for different natural hazards.

	Tornado	Earthquake	Hurricane	Flood
Initial engineering prompt	Using what you learned about severe weather and tornadoes, you will design a tornado-proof structure that is a minimum of 1 ft. high, 1 ft. wide, and 1 ft. deep. This "tornado" will be simulated with two fans: one placed one ft. away from, and blowing directly on, the roof; one placed 1 ft. away and blowing directly on one side of the house, which your teacher will select at random. The fans will begin on low for 10 seconds, increase to medium for 10 seconds, and then move to high for 10 seconds to simulate three different levels of tornado damage. During the high setting, three small items will be dropped on the roof to simulate flying debris.	Using what you learned about waves and earthquakes, you will design an earthquake-proof structure that is a minimum of 1 ft. high, 1 ft. wide, and 1 ft. deep. Your structure must be able to hold the weight of a tennis ball. Your structure will be transferred to a piece of cardboard. The "earthquake" will be simulated by your teacher consistently and gently shaking the cardboard for 30 seconds.	Using what you learned about severe weather and hurricanes, you will design a hurricane-proof structure that is a minimum of 1 ft. high, 1 ft. wide, and 1 ft. deep. This "hurricane" will be simulated with a fan on medium for 30 seconds, with the fan placed 1 ft. from your structure at the location of your teacher's choosing. For the second 15 seconds of the hurricane, precipitation will be simulated via a watering can. Three small items will be dropped on the roof to simulate flying debris.	Using what you learned about severe floods and floodplains, you will design a flood-proof structure that is a maximum of 1 ft. high, 1 ft. wide, and 1 ft. deep. Your structure must be able to hold the weight of a tennis ball. Your structure will be moved to and placed in a clear bin. The bin will be propped up on one end to a height of your teacher's choosing. You will place your structure in the middle of the bin, and the "flood" will be simulated with water running from one end of the bin to the other end for 30 seconds.

FIGURE 3: Natural hazards assessment (Regions of the United States 2020).

1. Locations and causes of hazards: For the following three questions, complete them all. Mark on the map provided in which region you would expect the natural hazard to occur. There may be more than one right answer!

   a. Write "tornado" in the region most likely for a tornado to occur. Write why tornadoes occur here.
   b. Write "hurricane" in the region most affected by hurricanes. Write why this area is most affected.
   c. Write "flood" in an area where a flood may occur. Write why a flood may occur there.
   d. Write "earthquake" in the region most likely to have an earthquake. Write why an earthquake would occur there.

2. Preparing for a hazard: For the following four scenarios, pick one and explain what you would do to prepare for this scenario. Then, predict the damage that the scenario will cause.
   a. You are sitting in your home, which has an upstairs, roof access, and a basement. Suddenly the tornado sirens start going off. You check your phone and see that a tornado is headed your way! The winds are up to 140 mph.
   b. You are outside playing basketball when your grandmother comes out and tells you there is a Category 1 hurricane expected in the area, but they are not asking residents to evacuate. Your house has an upstairs and roof access.
   c. You are inside watching your favorite TV show when it starts to rain very heavily outside. After a few minutes you look outside and see that the streets have already completely flooded! The news gives a flash flood warning.
   d. You live in an earthquake-prone area. Scientists predict an earthquake with a potential magnitude of 6 on the Richter scale will happen very soon.

3. Designing structures: Write a short reflection on the success of your group's structure. Make sure to include:
   a. If the scenario in Question 2 happened, how likely is it that your structure would have survived?
   b. What went well in your designs?
   c. What did not go well?
   d. What changes would you make to improve your structure?

4. Nature of science and engineering
   a. What are two ways you acted like scientists and engineers throughout our natural hazards lessons?

FIGURE 4: Learning targets and standards-based grading rubric (adapted from Wilcox 2011).

Learning targets

- Describe the patterns of natural disasters and explain how we can forecast them.
- Explain the causes of natural hazards.
- Describe how to prepare for a natural disaster.
- Analyze and interpret data to determine the effectiveness of a design.
- Articulate how we acted like scientists and engineers.

Standard score	Missing or incomplete	2	2.5	3	3.5	4
Level of understanding	**Cannot assess**	**Beginning**	**Developing**	**Capable**	**Strong**	**Exceptional**
Teacher language	The student did not turn in or complete the work.	Demonstrates little understanding alone, but partially understands with help.	Demonstrates partial understanding with significant gaps and minimal application.	Demonstrates understanding with minor gaps with little application. No major errors or omissions are present.	Demonstrates understanding, but has little application and/or minor errors.	Demonstrates a complete understating through applying their knowledge.
Student language	I didn't do this standard.	I need lots of help.	I need some help.	I have some questions.	I'm almost there.	I understand this very well and can apply it to new situations.