Third Grade Earth/Space Science

Protecting from the Weather: Design Solutions

Background Information

The Earth can be divided many different ways, one of which is by climate zones. Climate zones are classified by similar weather traits which have been observed for at least 30 years. Each climate zone has weather hazards. Extreme temperatures, cyclones, tornadoes, drought, and monsoons are just some of the hazards. Humans regularly build structures to reduce the impact of the climate, but extreme weather conditions can tax normal structures and new ones need to be constructed.

Performance Expectations

3-ESS3-1 Earth and Human Activity

Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

https://www.nextgenscience.org/pe/3-ess3-1-earth-and-human-activity

3-5-ETS1-3 Engineering Design

Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
https://www.nextgenscience.org/pe/3-5-ets1-3-engineering-design

Disciplinary Core Ideas

ESS3.B: Natural Hazards - A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

ETS1.B: Developing Possible Solutions - Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.

ETS1.C: Optimizing the Design Solution - Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Science and Engineering Practices

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

Crosscutting Concepts

Science is a Human Endeavor - Science affects everyday life.

Cause and effect relationships are routinely identified, tested, and used to explain change.

Objectives

- Students will design and build a structure to survive a weather hazard.
- Students will design a test to use in determining the quality of the structure.
- Students will use data to redesign and retest the structure.

Advance Preparation

- Decide what materials will be available for construction and testing.
- Decide if you want to have any size constraints on the structures.
- Determine how and what will be needed for testing of structures.
- Obtain resources for research of climate zones.

Materials

- Resources for Research
- Student Pages
- Possible Building Materials
  - Paper
  - Note Cards, Cardstock, Construction Paper
  - Clay
  - Craft Sticks
  - Various Types of Cloth
  - Tape/Glue/Other Binding Material
- Possible Items for Testing
  - Fan
  - Sandpaper
  - Squirt Bottle
  - Hair Dryer
  - Centimeter Cubes or Other Weights

Suggested Implementation

Place students into groups of 3-4. Either allow groups to select or assign a climate zone for the lesson. Groups will then research the climate zone. Allow ample time for groups to consider, discuss, and come to consensus about the following:

- *What are the seasons like in the climate zone?*
- *What problems could the weather possibly cause in the climate zone?*
- *Select a weather hazard from your climate zone that your group like to use for the rest of the lesson?*
- *What concerns are there about this hazard?*
- *What would you need to think about if you were building a house (insert structure) in the climate zone?*

Reconvene the class. Share that they will now discuss and plan a house that would be appropriate for the climate zone and weather hazard. Once designs are complete, have groups examine building materials to determine what and how they will be used. Another option is to display materials prior to the design phase. Groups now build their house.

Next, groups decide how the hazard will be simulated during testing of the house. Share the materials available for the testing phase. As groups complete the testing plans, they should carry out the tests. Data regarding test results should be recorded.

Repeat the design and testing process. Decisions as to prototype changes must be based on data from the initial testing. Groups share the climate zone, hazard, structure, rationale for design, and results of the testing.

Debrief

- *How did your group model the hazard during testing?*
- *What data did your group record?*
- *What went well with the group design?*
- *What would need to be changed? Explain your thoughts.*
- *Will any design be able to hold up in every storm (hazard) for location?*

Resources

- https://www.weather.gov/timeline
- https://www.weather.gov/ (current U.S. weather conditions
- https://climate.ncsu.edu/edu/Tilt
- https://www.wbdg.org/design-objectives/secure-safe/natural-hazards-mitigation

Book suggestions from: http://www.kbs.msu.edu/wp-content/uploads/2017/02/NGSS-Interactive-Read-Alouds.pdf

- Seuss, D. (1949). *Bartholomew and the oobleck.*
  This entertaining tale about a king who makes a new type of precipitation fall from the sky can serve as a great conversation-starter about designing solutions to weather-related hazards.
- Nivola, C. (2008). *Planting the trees of Kenya: The story of Wangari Mathaai.*
  Tells the story of a Kenyan activist who plants trees to combat the drought and erosion occurring in her town.
- Rose, C. (2015). *Over in the wetlands: A hurricane-on-the-bayou story.*
  Both people and animals were devastated by Katrina, although we often forget about the effect severe storms have on our non-human friends. Read through these pages to discover how animals prepare for a hurricane and what they find when they emerge after the storm.
- Simon, S. (2001). *Tornadoes.*
  A fact-filled book about severe storms: their structure, intensity and the scale used to measure the intensity, formation, and results of a tornado.

Assessment

The following single point rubric can be used to assess student understanding. For each of the criteria listed below, either circle the proficient description or add notes to a box indicating why the student's performance was either lacking or exceptional.

Areas that need improvement. **Developing Performance**	Criteria for **Proficient Performance**	Evidence of exceeding standards. **Advanced Performance**
	Can provide an explanation of their structure's design and testing procedure.	
	Can explain how their structure will survive a weather hazard.	
	Given a scenario involving a weather hazard, students will be able to explain how they would design and test a model.	