Humans and the Earth

By Christine Anne Royce

Elementary students are beginning to understand the Earth's natural processes and humans' impact on the Earth. Humans need the natural resources that the Earth produces, use these resources to develop civilizations, and make decisions to offset the damage they cause, as well as destruction that can occur through natural disasters.

This Month's Trade Books

Investigate Earth's Resources
By Sue Barraclough
ISBN: 978-1432914103
Heinemann
32 pages
Grades K–3

Synopsis

Through guiding questions, the book challenges readers to think about the types of natural resources that humans use. The topics range from fuel to water to trees to energy, which helps readers consider all of the different ways that the Earth helps us.

Earthquakes
By Seymour Simon
ISBN: 978-0060877156
Smithsonian
32 pages
Grades 4–6

Synopsis

Photographs and engaging text help introduce young readers to earthquakes, from how they happen to the damage they can cause. Map and diagrams help round out the book.

Curricular Connections

Young students can grasp at a basic level that humans need the Earth, even as the Earth takes its toll on humans. Children can also understand that humans need to protect the Earth's resources. In the first activity, students consider what resources are and where they come from by tracing human-made objects to their natural-resource origins. Once students learn about land (soil), air, water, and natural materials, they think about how they use these resources in their everyday lives and how they can reduce the use of these resources. Students then create posters to advocate for the Earth.

Older students can consider the impacts of natural disasters on humans and the ways in which humans use the Earth's resources to reduce the number of problems caused by these events. After students watch videos about the destructive nature of earthquakes, they develop a model of an earthquake-resistant house and test it. ■

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Grades K–2: Reducing Our Use of Natural Resources

Purpose

Students identify natural and human-made resources, learn that all materials come from the Earth, and communicate ways in which people can lessen their impact on the Earth by reducing their use of one resource.

Materials

- handful of marbles
- 2 or 3 books
- metal watering can
- packs of sticky notes in three different colors
- chart paper
- student data sheet (see NSTA Connection)
- *Investigate Earth's Resources*

Engage

Place the three objects found on page 24 of *Investigate Earth's Resources*—marbles, books, and a metal watering can—on a table at the front of the classroom. Ask students the question that the book poses on page 23: "Can you name the materials used to make these objects?" Give each student three sticky notes of different colors. Ask students to predict what material (substance) was used to make each object and place a sticky note with their answer on the side of their desk. The different-colored sticky notes keep the predictions separate; for example, all predictions about the marbles should be made on a blue sticky note, books on a green sticky note, and the watering can on a yellow sticky note. Common predictions include metal, glass, wood, paper, trees, and plastic. If students are not able to name a particular substance, ask them to draw another object that is made from the same material to illustrate the idea. Students can then explain their ideas when asked to share their predictions.

After all students make and record their predictions, ask them to share their thoughts. Using their answers, have students create a class bar graph for each of the objects using their sticky notes. You may need to assist students by asking them to come up by row or grouping them according to their predicted material. After students have generated the graphs, ask them to go one step further and pose the question, "Where do we get that resource?" For example, if students say that marbles are made of glass, ask them where glass comes from. Allow students to discuss where these different resources come from. Then, introduce the terms *natural resource* and *human-made product*. Ask students to generate a list of ideas about each term, including what they know about each, by recording their thoughts on chart paper.

Explore

Read *Investigate Earth's Resources* to students, stopping periodically to discuss the main points under each topic heading and to ask students the focus questions that are presented throughout the text. These main points produce

the key terminology associated with this topic: *materials*, *fuels*, *resource*, *product*, and *recycle* (CC ELA: Vocabulary Acquisition). After students have heard the story once, have a discussion about each of the following questions, which allow students to consider their own use of resources. Ask students to include on their student data sheet a sentence or illustration explaining where they personally use each type of resource.

- Water is a natural resource. How do you use water in your daily life?
- There are many different types of soil, and the kind you see depends on where you live. What do you need or use every day that requires soil? Explain why it needs soil.
- Trees can be used for fuel or for building. What do you use that can be made from trees?
- Fuels vary depending on where you live. What type of fuel do you use in your house? In your car?

Explain

Have students consider their answers to where and how they use natural resources in their daily lives. Then, select one particular resource that students will track their use of for 24 hours (e.g., water, paper). Depending on your students' age level, you can also do this as a class activity by tracking the amount of food that is prepared in the cafeteria compared to food wasted at lunch time, or by counting the number of water bottles placed in either the trash

versus the recycling bin. Ask students to use the bottom part of their data sheet to keep track of the resource they are using. Page nine of the text will give students a good example of how to create a chart that illustrates use. They can develop a similar method to track the number of sheets of paper, number of water bottles, or pounds of food they use. After students track their usage and develop a graph, ask them: "How does our usage of this resource impact the Earth?" Allow them to connect their understanding to the information in the text. Follow up their discussion with, "How can we reduce the impact we have on the land? Why is it a good idea to do this?"

Elaborate

After students discuss their ideas for reducing their impact and their rationale for why they should, share the video "Tips to Save the Environment" (see Internet Resources), which suggests ways in which people can reduce their overall impact on the environment. Ask students to use the back of their data sheet to develop a poster that will communicate one idea for reducing the use of a natural resource that is mentioned in the book. Their illustration should identify the resource, whether it is human-made or natural, where it comes from, and the steps people can take to reduce their consumption of that resource (CC ELA: Writing Standards K–5 – Text Types and Purposes).

Evaluate

Through students' initial predictions and explanations of natural versus human-made resources, the teacher can gain an initial understanding of what students understand about natural resources. By identifying one resource they personally use, students take their knowledge of resources and apply it to their own lives. Developing a poster allows students to use their new knowledge to create a product that can be assessed for terminology, understanding, and application of the material.

Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013):

K–2: Reducing Our Use of Natural Resources

K-ESS3 Earth and Human Activity

www.nextgenscience.org/kess3-earth-human-activity

The chart below makes one set of connections between the instruction outlined in this article and the *NGSS*. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities. The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectations listed below.

Performance Expectation	**Connections to Classroom Activity** *Students:*
K-ESS3-3 Communicate solutions that will reduce the impact of humans on the land, water, air and/or other living things in the local environment.	• create posters that represent how others can reduce their use of one particular natural resource by changing their behavior.
Science and Engineering Practice	
Obtaining, Evaluating, and Communicating Information	• consider what types of natural resources are used in the production of human-made resources. • communicate solutions to reduce the use of natural resources through the creation of a poster.
Disciplinary Core Idea	
ESS3.C: Human Impacts on Earth Systems • Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.	• create posters that represent how others can reduce their use of one particular natural resource by changing their behavior.
Crosscutting Concept	
Cause and Effect	• connect their use of natural resources to the impact it has on the Earth.

Grades 3–5: Living in an Earthquake Zone

Purpose

Through watching videos, students observe the destruction that happens in earthquake zones. Students then create an earthquake-resistant model house, test their design, and re-evaluate their model before a second test.

Materials

- shake table (see Resource for directions)
- student data sheet (see NSTA Connection)
- *Earthquakes*
- toothpicks
- miniature and large marshmallows
- fettuccini
- modeling clay
- pipe cleaners
- straws
- tape

Engage

Show students the "Earthquakes" video (see Internet Resources) and ask them to observe the types of destruction to a building or city an earthquake can cause. (*Note:* Videos often show dramatized or sensationalist images of earthquakes that are not representative of what actually happens and may not be appropriate for some children. Although it is important for students of this age to understand the impact of natural disasters, teachers should be cautious in the choice of video selected.) Also ask students to observe how the ground appears to move in the videos. Once students have viewed and discussed the videos, read *Earthquake* to them. Pause at the pages that show destruction from earthquakes and ask students to compare what they see in the pictures to what they saw in the video. Throughout the reading, ask students (CC ELA: Reading Standards for Informational Texts K–5):

- Why do you think some buildings totally collapsed and other buildings suffered only slight damage? (p. 6)
- Based on the map and key provided, where do you think communities would need buildings that can withstand an earthquake? (p. 11)
- What are some things that scientists need to consider when building in earthquake-prone areas? (p. 22)

Explore

Ask students to consider one thing could be done in advance to protect people during an earthquake. Although some students may discuss earthquake prediction to give people more time to evacuate, there is currently only one realistic way to save many lives: construction of earthquake-resistant structures. Ask students to watch both "Earthquake Protector" and "World's Largest Earthquake Test" (see Internet Resources), which show efforts to create earthquake-resistant buildings. Then, in teams of three, students create an earthquake-resistant structure that meets the following criteria and constraints:

- Criteria: House must be at least three stories high. Each story must be at least six inches high. Each story must be separated by a connector at each corner and indicated by a floor. Connectors can be a different type of material than the walls. House must be at least six inches by eight inches. The structure must withstand an earthquake that will shake it back and forth in a single direction.
- Constraints: Only materials provided by the teacher may be used. Use only one material set (do not mix and match materials across sets). Each structure must contain at least one rectangular shape and one triangular shape. For each building, use a maximum of 12 inches of tape.
- Materials sets will contain toothpicks and miniature marshmallows; fettuccine and clay; pipe cleaners and clay; or straws and large marshmallows.

Before beginning construction, groups must first complete the portions of their data sheet asking them to explain why their selected the materials set, using their ideas about strength and flexibility and a general knowledge of building structures; complete an initial structure diagram for discussion purposes; consult with the teacher, who should ask design questions about their illustration; and create a second illustration based on the consultation, noting any changes made.

Explain

Have each team present their structure to the class and explain why they designed the structure as they did, including the features that make it resistant to a simulated earthquake (CC ELA: Speaking and Listening Standards K–5 – Presentation of Knowledge and Ideas). After each group has explained its design, test the designs one at a time by placing each in the center of the shake table, pulling the string on the shake table a predesignated distance, and releasing. (*Note:* There are actually two types of waves that impact houses: *pressure waves*, which are simulated in

the shake-table method described, and *shear waves*, which cause a twisting motion. Shear waves can also be simulated by the shake table if students have learned about them in other lessons.) Students should make and record observations about what happens to their house during the shaking. Students should consider these questions, which can be provided in advance: Where was there stress on your structure? What happened at the stress points? What parts of the house stood up to the earthquake's forces? Did any part of the house not withstand the shaking and collapse? After students discuss what they observed from their model, ask them to make a third sketch of how they would change their structure to better withstand the earthquake. After they sketch and narratively note their changes, ask them to construct the improved house and retest.

Elaborate

After the retesting of the improved design, ask the students to compare their process to what they see in the video Nationwide Efforts to Make Buildings Earthquake Safe (see Internet Resources) and write a short explanation as to why their process was similar to what scientist have gone through over time in designing earthquake-resistant structures. Also, ask the students to make predictions as to what would happen to their newly designed buildings if the force of the earthquake was less than the redesigned building experienced and if it was greater. Why must this be considered by scientists when constructing earthquake-resistant buildings (CC ELA: Writing Standards K–5 – Text Types and Purposes)?

Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013):

3–5 Living in an Earthquake Zone

4-ESS3 Earth and Human Activity

www.nextgenscience.org/4ess3-earth-human-activity

The chart below makes one set of connections between the instruction outlined in this article and the *NGSS*. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities. The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectations listed below.

Performance Expectation	**Connections to Classroom Activity** *Students:*
4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	• design a model of an earthquake-resistant building using given criteria and constraints.
Science and Engineering Practice	
Constructing Explanations and Designing Solutions	• design a model of an earthquake-resistant building using given criteria and constraints, test their model, evaluate the positives and negatives associated with their design, and modify their design based on their observations. • generate and compare multiple solutions to a problem, based on how well they meet the criteria and constraints of the design solution.
Disciplinary Core Ideas	
ESS3.B: Natural Hazards • A variety of hazards result from natural processes. Humans cannot eliminate the hazards but can take steps to reduce their impacts. ETS1.B: Designing Solutions to Engineering Problems • Testing a solution involves investigating how well it performs under a range of likely conditions.	• design a model of an earthquake-resistant building using given criteria and constraints, test their model, evaluate the positives and negatives associated with their design, and modify their design based on their observations. • generate and compare multiple solutions to a problem, based on how well they meet the criteria and constraints of the design solution.
Crosscutting Concept	
Cause and Effect	• discover that structures with certain characteristics are more likely to withstand an earthquake.

Evaluate

Evaluation occurs at several points during this lesson. During the Engage phase, teachers can evaluate student understanding of informational text. The Explore and Explain phases ask students to consider what they have learned about earthquakes from the video and text, as well as what they understand about the design and engineering process through the creation, testing, revising, and retesting of a model. Finally, students apply their understanding of the design process to what scientists in the field do in the Elaborate section.

References

National Governors Association Center for Best Practices and Council of Chief State School Officers (NGAC and CCSSO). 2010. *Common core state standards*. Washington, DC: NGAC and CCSSO.

NGSS Lead States. 2013. *Next Generation Science Standards: For states, by states*. Washington, DC: National Academies Press. *www.nextgenscience.org/next-generation-science-standards*.

Resources

Gilstrap, T., P. Sheldon, and P. Schimmoeller. 2010. Shake it up. *Science and Children* 47 (6): 32–35.

Royce, C. 2015. Wonderful water. *Science and Children* 53 (2): 24–29.

Internet Resources

Earthquake Protector
www.youtube.com/watch?v=kzVvd4Dk6sw

Earthquakes
http://video.nationalgeographic.com/video/101-videos/earthquake-101?source=relatedvideo

Inside Earthquakes
http://video.nationalgeographic.com/video/inside-earthquake

Nationwide Efforts to Make Buildings Earthquake Safe
www.youtube.com/watch?v=I9g4tLcghPM

Natural Resources
www.youtube.com/watch?v=ue9jPH31lVo

Think Ecologically ... Reduce. Reuse. Recycle.
www.opened.com/video/think-ecologically-reduce-reuse-recycle/42845

Tips to Save the Environment
www.opened.com/video/tips-to-save-the-environment/110396

World's Largest Earthquake Test
www.youtube.com/watch?v=hSwjkG3nv1c

NSTA Connection

Download student data sheets and a list of additional books on this topic at *www.nsta.org/SC1603*.

Connecting to the *Common Core State Standards* (NGAC and CCSSO 2010)

This section provides the *Common Core State Standards for English Language Arts and/or Mathematics* addressed in this column to allow for cross-curricular planning and integration. The Standards state that students should be able to do the following at grade level.

English/Language Arts

Reading Standards for Informational Texts K–5 – Integration of Knowledge and Ideas

- Grade 3 standards ask students to "use information gained from illustrations and the words in a text to demonstrate understanding of the text."

Writing Standards K–5 – Text Types and Purposes

- Grade K students will "use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic."
- Grade 4 students will "write informative/explanatory texts to examine a topic and convey ideas and information clearly."

Vocabulary Acquisition and Use is one of the standards for language. This particular standard is across grade levels. "Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade [appropriate] reading and content."

Speaking and Listening Standards K–5 – Presentation of Knowledge and Ideas

- Grade 4 students should "report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Furthermore, the *Common Core* for ELA provide a standard related to the Range of Text Types for K–5 where it indicates that students in K–5 should apply the Reading standards to a wide range of texts to include informational science books.