Mathematics: The Language of STEM
Earthquake Challenge
Tracy Love

CONTENT AND TASK DECISIONS

Grade Level(s): 4

Description of the Task: Students will build structures that will withstand a faux earthquake without falling apart. Students will predict the area and perimeter that the effects of an earthquake would be felt.

Indiana Mathematics Content Standards: 4.NS.7: Compare two decimals to hundredths by reasoning about their size based on the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions (e.g., by using a visual model). **4.NS.9:** Use place value understanding to round multi-digit whole numbers to any given place value. **4.M.4:** Apply the area and perimeter formulas for rectangles to solve real-world problems and other mathematical problems. Recognize area as additive and find the area of complex shapes composed of rectangles by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts; apply this technique to solve real-world problems and other mathematical problems.

Indiana Science Content Standards:
4.PS.4 Describe and investigate the different ways in which energy can be generated and/or converted from one form of energy to another form of energy. **4.ESS.3** Describe how geological forces change the shape of the land suddenly and over time. **3-5.E.3** Construct and perform fair investigations in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Indiana Mathematics Process Standards: PS.1: Make sense of problems and persevere in solving them. **PS.3**: Construct viable arguments and critique the reasoning of others. **PS.4:** Model with mathematics. **PS.5:** Use appropriate tools strategically. **PS.7**: Look for and make use of structure. **PS.8:** Look for and express regularity in repeated reasoning**.**

Science Content Goals: Students will understand how to build a structure according to a rubric that will withstand the force of an "earthquake".

Math Content Goals: Students will compute the area around the "epicenter" of the "earthquake" where the "earthquake" could be felt.

Language Objectives: Students will understand math & science vocabulary: *earthquake, epicenter, Richter Scale, area, perimeter, energy, tectonic plates*, and *miles*. Students will use academic vocabulary when talking about the project.

Materials: maps, casserole dish, gelatin in casserole dish, wooden Popsicle sticks, marshmallows, rubber bands, binder clips, toothpicks.

THE LESSON

Before: This phase of the lesson should be designed to get students ready for problem solving. It also provides an opportunity for you to find out what they already know about the topic. Describe how you will accomplish each of the following in this phase of the lesson:

- **Activate prior knowledge:** What is an earthquake? What happens during an earthquake? How do you measure the energy from an earthquake? How does the energy from an earthquake spread and how far does it spread? How do you measure area? What unit would you use to measure the spread of earthquake energy from the epicenter?
- **Be sure the problem is understood:** Two problems: 1.) Build a structure that will withstand an "earthquake". 2.) Figure out the area of the earthquake energy based on the epicenter.
- **Establish clear expectations:** Students will work in groups to design and build a structure that will withstand an earthquake. Students will use a map to figure out how far from an earthquake epicenter the energy would be felt.

During: This phase of the lesson should be designed for students to explore the focus task. Describe specifically what the students will be doing in this phase. Include a description of how the students will record their mathematical thinking in writing or drawing throughout the investigation. Describe how you will accomplish each of the following in this phase of the lesson:

- **Let go:** turn students loose to design and build. Once they have experienced the "earthquake", they will calculate the area of the earthquake.
- **Listen actively:** Why have you decided to use this material? Why have you decided to make it that size? What do you predict will happen to your structure during the earthquake?
- **Provide appropriate support**: What do you know about building structures and their ability to withstand an earthquake? What do you know about the area of an earthquake and the strength of an earthquake? What do you know about how an earthquake is measured?
- **Provide worthwhile extensions**: Students will explore famous earthquakes that have occurred.

After: In this portion of the lesson, students should work as a community of learners, discussing, justifying, and challenging various solutions to the problem all have just worked on. Here is where much of the learning will occur. It is critical to plan sufficient time for a discussion and make sure the During portion does not go on for too long. Describe how you will accomplish each of the following:

- **Promote a mathematical community of learners:** We will reconvene as a class, share out our hypotheses, and then organize our numbers from our area calculations in a table. We will compare our areas and each group can show us how they figured theirs.
- **Listen actively without evaluation**: What were your thoughts as you did that? Why did you do it that way?
- **Make connections:** What are the similarities and differences between the groups' data?
- **Summarize main ideas:** What is the connection between the force of an earthquake and its effected area?

ASSESSMENT

Observe: I will observe the students' hypotheses and listen to their data.

Ask: I will ask the students to reflect on their learning in writing.
*What went right during the experiment? Did anything go wrong? Were you surprised by your

findings?
*Please use accurate use of the vocabulary terms when writing.