LESSON SEED FOR INTEGRATING CONTENT STANDARDS IN AN ELEMENTARY STEM-CENTRIC LEARNING EXPERIENCE (Grades 3 through 5 with appropriate adjustments, as necessary)

Teacher	Content Standards	Potential Activities	Real-World Connection
 **Attributes of a STEM-centric minded elementary teacher**: • Collaborate with educators in other disciplines to develop integrated lessons. • Facilitate student engagement and questioning – this includes asking questions that promote higher order thinking and guiding students through the problem solving process. • Involve students in the real-world application of content. • Provide opportunities for students to design and conduct investigations to address the real-world connection. • Facilitate learning experiences that allow for the intentional and purposeful integration and application of content. • Provide support to students in their use of technology for exploration of the real-world connection. • Conduct ongoing assessments of students' performance, both formally and informally, to guide instruction and raise the quality of teaching.	**Mathematics** **4.MD.1** Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. **4.MD.2** Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.	**Mathematics** Students can measure the sizes and lengths of their building materials as well as the height of the structure they are building and compare to those used by others in the class. Students determine how the height of the structure they build affects its stability, its ability to survive the simulated earthquake, and the nature of the damage that occurs to the structure. Students will measure length using the metric system. Students should convert their scale model into real dimensions (for example, in your scale model, if 0.5 cm = 1.0 M in actual height, then how tall is the structure you built or use 1:1 conversion).	**Earthquake in Maryland on August 23, 2011**: A 5.8 earthquake struck the D.C. area and beyond, shaking buildings, shattering windows and causing major traffic delays in the region. **Read more:** http://www.wjla.com/articles/2011/08/earthquake-felt-in-washington-d-c-area-65531.html#ixzz32yVZGFGh **Earthquake Resources:** Resources on earthquakes are provided in a separate document titled, "Earthquake Resources." This document gives the URLs for web sites featuring data, articles, animations, simulations, and other resources may be useful in this lesson seed. **Essential Questions**: • How can buildings be constructed to reduce damage during earthquakes? • Describe the relationship between the locations of earthquakes and volcanoes and the shapes of the crustal plates. **Culminating Activity**: Students use a variety of materials to build scale models of structures that can withstand rigorous movements representing an earthquake. For example, students could use spaghetti strands, soda straws, pipe cleaners/chenille stems, popsicle sticks, small dowel rods, etc. and attach them together with marshmallows. Students should note the characteristics of the materials they use (for example, spaghetti strands are brittle but stronger when used in groups, soda straws are tubular, pipe cleaners are flexible, etc.). The initial challenge is to see how tall of a self-supporting structure they can build in a given period of time. The structure should be built on top of a piece of construction paper. After the initial challenge, students should move the paper back and forth representing movements similar to those seen in earthquakes (to represent different magnitudes of
	Science **ESS2.B: Plate Tectonics and Large-Scale System Interactions** The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4-ESS2-2)	**Science** Students can research the correlation between the location and frequency of earthquakes and the boundaries of the crustal plates. Research needs to include the opportunity to examine various types of maps including a map of tectonic plates and correlating that information with maps showing continents, surface features, and features of the ocean floor.	
	English Language Arts **RI7** Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.	**English Language Arts** Students look at data sets (a different type of textual reference) on earthquakes in the USA (statistics such as maps, locations, magnitude, dates, amount of damage, number of deaths, etc.). Students should use the data to assist them in understanding vocabulary and details presented in an article they read about the 5.8 magnitude earthquake in August 2011.	

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Social Studies
Geography: Topic A. Using Geographic Tools
Indicator: Use geographic tools to locate places and describe the human and physical characteristics of those places.
Objectives:

- Construct and interpret a variety of maps using map elements.
- Use photographs, maps, charts, graphs, and atlases to describe geographic characteristics of Maryland/United States.
- Identify and locate natural/physical features and human-made features of Maryland such as Appalachian Mountains, Piedmont Plateau, and Atlantic Coastal Plain.
- Identify and locate natural/physical features and human-made features of the United States.

Social Studies
Students will use a map of the United States (or world map showing the USA) that indicates the location of earthquakes (and volcanic activity) in order to make the connection between the location of these events and the boundaries of the crustal plates (plate tectonics), and predict the likelihood of where earthquakes will occur.

Engineering Design Process
Teachers should take students through the engineering design process as they design and redesign and build their structure.

Engineering Design Process
Use a model that is most appropriate for your needs (*e.g.*, the ITEEA engineering design model which can be found on *msde.blackboard.com*. Look on the left menu under "Professional Learning Resources – "2013 Educator Effectiveness Academy Resources" – "Engineering").

STEM Standards of Practice (SOPs)
1. Learn and Apply Rigorous Science, Technology, Engineering, and Mathematics Content
2. Integrate Science, Technology, Engineering, and Mathematics Content
3. Interpret and Communicate STEM Information
4. Engage in Inquiry
5. Engage in Logical Reasoning
6. Collaborate as a STEM Team
7. Apply Technology Appropriately

STEM SOPs
Please be sure to incorporate the SOPs appropriate to the STEM learning experience you are creating. You may or may not be able to incorporate all seven STEM SOPs into every aspect of a lesson. However, in a STEM unit, which is typically longer and more global in scope, the expectation is that all seven STEM Standards of Practice will be addressed.

Feel free to use other content standards as appropriate that have a natural fit – for example, Visual Arts as it relates to principles of design and materials.

earthquakes as measured by the Richter Scale). Very likely their structure will collapse. They should then examine the pieces and make notes about what happened (for example, pieces broke, joints came apart; shorter structures probably survived better than taller structures, etc.). In the next part of the challenge, students should design and rebuild their structures to make them more earthquake-proof. Based on their research about the location and frequency of earthquakes and the boundaries of the crustal plates, students should also identify an area of the earth where they would want to construct their buildings and relate the locations they select to the types of building materials they use and the kinds of buildings they construct.

NOTE: Make sure that you facilitate the students' understanding of the relationships between this activity and the standards being referenced. For example, if the structure they built is in Maryland where the frequency and magnitude of earthquakes is less, vs. being located in California where the frequency and magnitude of earthquakes is greater, how does that impact regulations and guidelines for the construction of their model (**OR** what policies should be in place to influence safety regulations relative to building construction).

Career Connections: Seismologist; Architect; Geoscientist; Surveyor; City Planner; Cartographer; Historian; Volcanologist; Environmental Geophysicist; Geologist; Geodynamicist; Geodesist; Geophysical Modeler; and others that are appropriate