Lesson Title	Sand Cities
Length of Lesson	1day
Created By	Claire Babineaux
Subject	Inquiry, Earth and Space Science, Geology
Grade Level	7-8th Grade
State Standards	1.a, 4.b
DOK Level	1,3
DOK Application	Critique, assess, compare, develop a logical argument, hypothesize
National Standards	5-8: A: abilities necessary to do scientific inquiry 5-8: D: structure of the earth system & the earth today

Graduate Research Element

Student Learning Goal:
The goal of this lesson is to present earthquake and seismic information to an 8th grade science class at a DOK level of 3.

State Standards:
1.a: Design, conduct, and analyze conclusions from an investigation that includes using experimental controls. *The students will create earthquakes and determine what type of sediment is ideal to build a city on.*
4.b: Describe the cause and effect relationship between the composition of and movement within the earth's lithosphere. Seismic wave velocities of earthquakes and volcanoes to lithospheric plate boundaries using seismic data. *Students will learn about the waves that are associated with earthquakes, how they travel, and the damage associated with them.*

National Standards:
A: think critically and logically to make relationships between evidence and explanations. *Students will be able to describe what happens and determine which sediment is the best to build on.*
D: Land forms are the result of a combination of constructive and destructive forces. *Students will learn about the waves that cause earthquakes.*

Materials Needed (supplies, hand-outs, resources):
Sand, small clear cups, pennies, nails, washers, water, spray bottles

Lesson Performance Task/Assessment:
The students will demonstrate their understanding for this lesson by answering questions provided on the worksheet by using critical thinking and investigations they conduct throughout the activity.

Lesson Relevance to Performance Task and Students:

Students will be able to understand what causes earthquakes, the waves that stem from an earthquake, how they propagate out from a point, and the damage caused by earthquakes. They will demonstrate their understanding by thinking critically and answering questions.

Anticipatory Set/Capture Interest:
Intro to earthquakes, p & s waves, consolidated sediments, and unconsolidated sediments. The teacher will then simulate a series of earthquakes (see teacher's notes for directions). Also, the teacher can use a slinky to produce longitudinal and transverse waves.

Guided Practice:
The teacher will review waves, and types of sediments. The teacher will then hand out the Sand Cities worksheet and review the steps.

Independent Practice:
Sand cities worksheet. Students will determine what will happen to cities built on different types of sediments- ex. Unconsolidated = New Orleans, LA; consolidated = Columbus, MS; Saturated = San Francisco, CA. Students will also be able to determine the best sediment to recommend for building of cities.

Remediation and/or Enrichment:
Individual IEP, the teacher can separate students into groups and have them work together.

Check(s) for Understanding:
The students will demonstrate their understanding for this lesson by completing questions that are presented on the Sand Cities worksheet and then discussing their answers with the class.

Closure:
A teacher/student led discussion of earthquakes, damages, and locations (leading into plate tectonics lesson).

Possible Alternate Subject Integrations:
Mathematics: The rate at which p and s waves move in the subsurface can be integrated.

Teacher Notes:

Previous knowledge of plate boundaries, volcanoes and plate movement is needed to complete this lesson plan.

<u>Anticipatory set directions</u>:

Line students up by size (i.e. biggest/tallest on one end and smallest/shortest is on the other end. The student teacher or student volunteer will stand on end nearest the smallest student.) Be sure the students are shoulder to shoulder and in a straight line.
--To simulate an S wave in unconsolidated sediments, simply make sure they are shoulder to shoulder and then send a compression wave through the students by pushing the largest student.
--To simulate an S wave in consolidated sediment, have the students' link arms at the shoulders and then repeat the sending of a compression wave through them.
--To simulate a P wave in unconsolidated sediment, have the students' line up shoulder to shoulder. Then have the largest student bend forward and back at the waist.
--To simulate a P wave in consolidated sediment, have the students' link arms at the shoulders again. Then have the largest student bend forward and back at the waist.

The students should be able to notice the difference in the two waves: speed, movement etc.