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Module 3: Workshop 9

Lesson Plan

Overall Learning Goals	**Lesson Topic**
Strategies for Developing Common Core Skills in Content Areas (Math & Science): to train administrators and adult educators *to develop instructional strategies* for developing Common Core skills in content areas to better serve their ESOL, ABE, and pre-HSE student constituency.	Reviewing the cross-cutting concepts involved in solving problems placed on students in TASC about disciplinary core ideas posed in the physical sciences, life sciences, earth & space sciences, and scientific & engineering practices, with a focus on coherent instruction involving questioning strategies in problem-solving classrooms.
Curriculum Developer Lizelena Iglesias **Workshop Trainer**	**Date** **Location**

Intended Audience

- **Instructors** (content was designed as a workshop for Instructors).
- Note: Sample student material is included for Instructors to analyze and engage in during the workshop. Instructors may also use sample student materials in their classes. (Specifically, see Part 4.).

Standards Alignment

Next Generation Science and Engineering (NGSS) Standards:

- Earth's Systems
  - MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
  - HS-ESS1-5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.
- NGSS Science and Engineering Practices
  - Analyzing and interpreting data

The Common Core CCSS ELA/Literacy Standards:

- CCSS.ELA-Literacy.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.
- CCSS.ELA-Literacy.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- CCSS.ELA-LITERACY.WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
- CCSS.ELA-Literacy.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

The Common Core CCSS Mathematics Standards of Mathematical Practice:

- CCSS.Math.Practice.MP2 Reason abstractly and quantitatively.

Goals and Objectives

- Facilitators will engage in analysis of science crosscutting concepts.
- Facilitators will engage in a science practice.
- Facilitators will refresh content related to plate tectonics.
- Participants will become familiar with crosscutting concepts while engaging in science practices exploring content needed for the TASC.
- Participants will analyze earthquake patterns and compare how they relate to plate boundaries.
- Participants will engage in data analysis about earthquakes.

The TASC Transition curriculum is a collaborative project of the New York State Education Department and the Queens Borough Public Library, supported by funding from the New York State Department of Labor.

- Participants will refresh content related to plate tectonics.

References (APA Style)

- Contant, T. L. Framing Science. Methods for Teaching Science through Inquiry and Investigation (chapter 1). Retrieved from http://www.pearsonhighered.com/assets/hip/us/hip_us_pearsonhighered/samplechapter/0133400794.pdf
- *Common Core Achieve, Science Subject Module* (1st ed.). (2014). McGraw Hill/Contemporary.
- *Common Core Achieve, Instructor Resource Guide, Science* (1st ed.). (2015). McGraw Hill Education.
- How Science Works | California Academy of Sciences. (2012, November 6). Retrieved June 25, 2015, from http://www.calacademy.org/explore-science/how-science-works.
- Exploring Earth: Plate Tectonics. (2006, June 1). Retrieved June 25, 2015, from http://achieve.lausd.net/cms/lib08/CA01000043/Centricity/Domain/249/Middle School files/Grade 6 Plate Tectonics lesson/PlateTectonics2007_BW_0.pdf
- Science and Engineering Practices. (n.d.). Retrieved June 25, 2015, from https://neuron.illinois.edu/files/sessions/541/NGSSposters.pdf
- Plates & Boundaries. (2014). Retrieved June 25, 2015, from http://www.learner.org/interactives/dynamicearth/plate.html
- Earthquakes. (n.d.). Retrieved June 25, 2015, from http://earthquake.usgs.gov/earthquakes/?source=sitenav.

Technology and Handouts

Technology Needs

- AV cart with projector, laptop, and speakers will be provided.
- Laptop or tablet computer for each student with access to Internet.
- Latest version of Adobe Flash installed on laptops.

Presentation Needs & Handouts

Each item listed below will be available in PDF format:

Warm Up

Handout with the shifts in science education and science practices, crosscutting concepts and disciplinary core ideas.

Lesson Part 1-Teacher Workshop

- Handout 2: Table with Crosscutting concepts and questions.
- Reflection Sheet 1.

Lesson Part 2-Teacher Workshop

- Handout 3: Color map with text from the Common Core Achieve Science Textbook. Pages 307-308.
- List of geographical Features with plate boundaries.

Lesson Part 3-Teacher Workshop

- Color map from http://earthquake.usgs.gov/earthquakes/world/seismicity_maps/world.pdf.
- Reflection Sheet 2.

Student Lesson

- Handout for students.
- Exit slip.

Lesson Plan Activities

Part 1: Teacher Workshop - Intro to the Second Dimension (Framing It)

Lesson Content

From Contant, T. L. Framing Science. Methods for Teaching Science through Inquiry and Investigation (chapter 1).

Lesson Materials

- Handout 2: Table from http://www.pearsonhighered.com/assets/hip/us/hip_us_pearsonhighered/samplechapter/0133400794.pdf containing all crosscutting concepts with explanations and aligned activities.
- Video about the nature of science found at http://www.calacademy.org/explore-science/how-science-works to identify crosscutting concepts in use.
- Teacher Reflection Sheet to close the lesson activity.

Questions to Answers

- What crosscutting concept or concepts must the scientists engaged in to decide if the new spider was new to the world

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or not? (Structure and function, patterns).

- What does the video tell us about the nature of science and what are the implications for science instruction?

Lesson Activities

- Activity 1: Participants will be given the **Handout 2** containing a table with the description of all crosscutting concepts and suggested activities.
  - They will split into groups and will be asked to read the table and identify the crosscutting concept and the activity that, in their opinion, is best aligned with it. They will be asked to be ready to explain their choosing.
  - In addition, they will have to come up with one additional activity that can relate to the crosscutting concept the group selected to work with.

TABLE 1-7 Dimension 3—Crosscutting Concepts

Crosscutting Concept	Importance	Example of a Learning Activity in Which This Crosscutting Concept Is Evident
Patterns	• Guide organization and classification • Stimulate questions about relationships and factors that influence them.	• Using climate data from various cities, students look for patterns in the variation of average monthly temperature over time.
Cause and effect: Mechanism and explanation	• Events have causes. • Recognize causality vs. correlation. • Find out "what makes" or "why" something happened and "how" it happened.	• Students investigate factors that might explain the variations in monthly temperature they observed in the climate data and argue from evidence to support their claims.
Scale, proportion, and quantity	• Relative size (time, energy) matters when considering a system's structure or performance.	• Students wonder about variations in average temperature over different time scales. Hourly temperature over a week, daily temperature over a month, yearly temperature over a century. Then they design investigations to enable them to address their questions.
Systems and system models	• Systems are often too complicated to be studied or understood without specifying boundaries or considering their component parts in isolation.	• Students create a model or use a computer simulation illustrating the motion of the sun across the sky in different months to explain the patterns they observed in the monthly average high temperature data for their city.
Energy and matter: Flows, cycles, and conservation	• Possibilities and limitations of systems are easier to understand when you know how matter and energy move into, out of, and between systems.	• Students create a model to investigate how the length of the day and the angle of the sun relate to the amount of energy from the sun striking an area on Earth's surface and the resultant change in air temperature.
Structure and function	• The shape of an object, living thing, or system is related to what it does, how well it does it, and how it works. • The overall structure of an object, living thing, or system is often related to its substructure.	• Students investigate how the shape of a translucent container placed in direct sunlight affects the rate of heating of its contents. Then they try to design a container that minimizes the temperature change of its contents when placed in direct sunlight.
Stability and change	• Systems change or remain stable, but the time frame of the study is important. • Rates of change matter. • When a system is stable, competing effects balance each other.	• Students explore the literature about climate change, then present an evidence-based argument supporting their conclusion about whether or not global warming is occurring and if it is human-caused.

http://www.pearsonhighered.com/assets/hip/us/hip_us_pearsonhighered/samplechapter/0133400794.pdf

  - Facilitator will bring the group together to discuss answers.
- Activity 2: Facilitator will show the video How science works found at http://www.calacademy.org/explore-science/how-science-works and will pose the following questions:
  - What crosscutting concept or concepts must the scientists engaged in to decide if the new spider was new to the world or not? (Structure and function, patterns)
  - What does the video tell us about the nature of science and what are the implications for science instruction?

Wrap Up/Assessment

Teacher Reflection Sheet 1

- Individually now, facilitator will ask participants to go back to the table and from the importance column select one or two bulleted points they feel are important in science.
- Then, further explain why they are so.

Part 2: Teacher Workshop - What's the crosscutting concept?

Lesson Content

Participants will be asked to go back to handout 2 and match the crosscutting concept that best fit this activity. Ideas will be discussed in the larger group.

Lesson Materials

- Map of the Earth with main tectonic plates and the direction of their movement http://www.yalescientific.org/wp-content/uploads/2013/02/quake1-500x280.jpg
- Alive site with global map with seismic activity http://ds.iris.edu/seismon/index.phtml
- Handout 3 with descriptions of the three types of plate boundaries from the Common Core Achieve Science textbook. Pages 307-308
- List of geographical features on Earth caused by tectonic plate activity. Handout 4.

Lesson Activities

- Activity 1: Participants are broken into groups and they are given a map of the Earth which shows the main tectonic plates and the direction which they are moving.
  - They will also receive a document with a description of the 3 types of plate boundaries: convergent, divergent, transform to support their answers.
  - Participants are asked to look at the map and to identify which type of tectonic plate boundaries they think exist in certain marked locations.
  - Facilitator will bring the groups together and will discuss answers. Facilitator will project the descriptions of the plate boundaries from the Power Point to aid the discussion.
- Activity 2: Participants are then given a list of geographical features on the earth which are directly caused by tectonic

plate activity. Facilitator will ask participants to match up these geographical features with the differing types of plate boundaries.
    - The teacher will then reinforce this by pointing out the location of
        - The Himalayan Mountains (convergent)
        - The Great Rift Valley (divergent)
        - San Andreas Fault (transform)

Wrap Up/Assessment
Re-read the copy from the Common Core Achieve textbook and find in the text the paragraph that explains what causes the plates to move. Paraphrase the paragraph.

Part 3: Teacher Workshop - Identifying Seismic Patterns Around the World

Lesson Content
The focus of this professional development workshop will be to identify seismic patterns around the world, but also to explore the relationship between earthquakes and tectonic plate boundaries as well as analyze characteristics of all earthquakes utilizing visuals for discussion – as a way to generate lesson plans and activities for students in a classroom setting.

Lesson Materials
- Site with global map with seismic activity http://ds.iris.edu/seismon/index.phtml.
- Earthquake Prediction Handout 5.
- Global Map with Seismic activity found at http://earthquake.usgs.gov/earthquakes/world/seismicity_maps/world.pdf.
- Reflection Assessment Sheet 2.

Questions to Answer
- What is the relationship between earthquakes and tectonic plate boundaries?
- Do you think all earthquakes have the same characteristics? What determines this? Use your maps to support your answers.

Lesson Activities
- Activity 1: As a warm up, facilitator will ask participants to form into their groups and to answer to the following questions:
    - Questions will be projected on the Power Point and the Facilitator will call for answers.
        - How often do you think earthquakes happen?
        - Where do they happen?
        - When do you think the last earthquake occurred? Yesterday? Last week? A few years ago?
        - How often do you think there is an earthquake somewhere in the world?
        - Does every part of the world experience earthquakes?
- Activity 2: Groups will be given now a color copy of a global Earthquake map from http://earthquake.usgs.gov/earthquakes/world/seismicity_maps/world.pdf and will be asked to identify what patterns they notice in the map about seismic activity and how this pattern match their previous predictions or analyze if this pattern tells them something differently.
    - Before calling groups for a larger discussion, facilitator will show the following alive map that shows seismic activity around the world and will be ask to conclude their observations. http://ds.iris.edu/seismon/index.phtml.

Wrap Up/Assessment
Reflection Assessment Sheet 2
- Name the science practice or practices that you think were used during this activity. Explain your reasoning.
- How was the crosscutting concept expressed in this lesson? Do you see opportunities for another one? Explain.
- To help participants remember the practices, point at the posters or bring the slide from the Power Point.

Part 4: Researching and Analyzing Real Time Earthquake Data

Lesson Content
This lesson presumes that students are familiar with Earth's structure, composition and The Theory of Plate Tectonics.
Lesson Materials
- Common Core Achieve Science. Instructor Resource Guide. Pages 135-136.
- Access to tablets or computer to access the internet.
- Reflection Sheets per group.

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- Color copy of a World map with plate boundaries per group.
- Exit Slip.

Question to Answer

Bring the class together to discuss participants' results. Ask them what does the data tell us about Earth's tectonic activity and what is the relationship between earthquake and plate boundary?

Warm Up/Review

- Facilitator will have participants access the Annenberg Interactive Dynamic Earth found at http://www.learner.org/interactives/dynamicearth/plate.html.
- Participants will be asked to click on the Plate and Boundaries tab and review the material and then take the challenge at the bottom of the page.
- Facilitator will ask participants how they did in the challenge and quickly remind the students about the theory of plate tectonics.

Lesson Activities

- Activity 1: In your groups, use your tables to access the USGS home page: http://earthquake.usgs.gov/earthquakes/?source=sitenav and locate a real time earthquake map.
  - Select at least 15 recent or current earthquakes and gather data such as location, magnitude and depth.
  - Organize your data in the format of your liking.
- Activity 2: Once your data is organized, proceed to answer the discussion questions that follow:
  - Describe what pattern you see while comparing the location of the earthquakes with the location of tectonic plate boundaries that you have in your maps.
  - Look at the magnitude of the earthquakes your group selected. Organize the earthquakes by their magnitude range (1-3, 4-6, or 7-9).
    - Which range has the greatest number or earthquakes?
    - Which has the fewest?
  - Earthquakes are classified as shallow, intermediate and deep depending on their depth (up to 70, 70 to 300 and below 300km respectively).
    - Which depth range has the most earthquakes?
    - Which has the fewest?
    - How does the depth of the earthquake relate to the shaking it causes?
    - Which types of plate boundaries have experienced the largest amount of earthquakes?
    - What are the risks of human population in these areas?

Wrap Up-Assessment

Exit Slip

- How did the data you gather in your group help you answer the discussion questions?
- Besides looking at the numerical data, what other considerations did you have to answer to the discussion questions?

Overall Wrap Up

Note: this part will be done in a discussion format.

- Participant will tell participants that most major geologic events occur at the boundaries between tectonic plates, where huge, massive pieces of the earth's crust interact. Each kind of plate boundary is associated with particular events, so if you know about the movements taking place at a plate boundary, you can often predict what's likely to occur there — volcanoes, earthquakes, mountains, trenches, etc.
- Facilitator will ask the participants if they see any benefit in analyzing seismic data to prevent hazards in areas with significant seismic risks.

Project/Homework

- What factors do you think should be considered when developing policies to protect people living in areas that are at risk from natural hazard?

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