Lesson Research Proposal for Fourth Grade Earth Science
For the lesson on November 7, 2017
Science Conference: “Its Go Time: Science for All”
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1. **Title of the Lesson: Building Landform Profiles**

2. **Brief Description of the lesson:** Students will match 3D models of landforms to topographic maps and profiles.

3. **Research Theme:** Deepen students’ scientific understanding by providing first hand experiences, engaging students in discourse, and completing scientific journaling.

4**. Goals of the Unit:** This unit provides students with direct experiences with soils, rocks, and modeling – using scientific tools of stream tables and topographic maps – to study changes to Earth’s surface.

5. **Goals of the lesson:** The goal of the lesson is for students to be able to relate topographic maps, 3D models of landforms, and profiles to one another. By comparing multiple models of mountains, students will be able to articulate patterns in landform formation and how these patterns are shown in topographer’s tools.

6. **Relationship of the Unit to the Standards**

Second Grade (prior to this grade)	**Fourth Grade (These students now)**	**Fifth Grade (Next year)**
2-ESS2-2: Develop a model to represent the shapes and kinds of land and bodies of water in an area. 2-ESS2-3: Obtain information to identify where water is found on Earth and that it can be solid or liquid.	4-ESS2-1: Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. 4-ESS2-2: Analyze and interpret data from maps to describe patterns in Earth’s features.	5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. 5-ESS2-2: Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

7. **Background and Rationale:**

Our school is deepening its understanding of science teaching this year. Throughout the year, we will implement three science units in our grade level. While implementing these units, we are also practicing science notebook writing, using KLEWS charts to support argumentation, and working on using productive talk to support students' thinking and their relationships with one another.

Students at Dr. Weeks elementary are good at asking questions and making detailed observations. We're working on developing their skills to record these observations in their notebooks and build on these observations in their science writing. We're also working with students to use productive and accountable talk moves, using agreement, disagreement, adding on, and clarifying. Leading up to this research lesson, we've noticed our students making detailed observations of the impact of acid rain on various kinds of rocks, the impact of differing slopes on the flow of water over a landform, and the ways landforms change when water moves over them. As we've taught these lessons, we've followed the structure of the unit designed by the University of California at Berkeley, known as the Full Option Science System, and distributed by School Specialty, Inc.

8. **Research and Kyouzai kenkyuu:**

While preparing our research lesson, we studied the Framework for Science Education, particularly the sections that applied to the fourth grade standards our unit was designed to address. In particular, we focused on 4-ESS2-2. This performance expectation, like the others in the NGSS, weaves together three components: (1) the scientific practice of analyzing and interpreting data; (2) the disciplinary core idea of plate tectonics and large-scale system interactions; and (3) the crosscutting concept of patterns.

The practice of analyzing and interpreting data begins at the elementary level. In the early years, students need support to notice they need to record observations. They can do so as drawings, words, or using counts and measurements. They need additional support to organize that data into tables or graphs. In intermediate elementary grades, they can begin with very basic statistical analysis (although that is not the goal of our research lesson). Data representations can help students use the data as evidence when building an argument.

The disciplinary core idea of plate tectonics and large-scale system interactions may initially seem removed from a unit that focuses on soils, rocks, and landforms. However, recognizing the locations of sand and soils, as well as rivers, streams, lakes, and ponds, is a first step to noticing that there are patterns to these formations and their locations. These observations are built upon later – in this unit – by noticing the locations of major formations and events like mountain ranges, volcanoes, and earthquakes. Maps and other representations, like those featured in our research lesson, help students to recognize patterns in these features and their locations.

The crosscutting concept of patterns fits well with the practice and disciplinary core idea of this performance expectation. For elementary learners, noticing patterns is a precursor to asking questions about how and why they occur. Scientific explanations, as well as engineering designs, build upon pattern recognition. Data representations can assist students in recognizing patterns. In early elementary grades, students need to notice, classify, and record patterns. This ability is built upon in the intermediate grades as students begin to develop the skills to recognize patterns in rates of change – an idea that is touched upon with the stream tables in this unit.

9. **Unit Plan**

Lesson	Learning Goals and tasks
1	Students investigate properties of soil by comparing four different soils. They learn that soils are composed of essentially the same types of materials (inorganic earth materials and humus), but the amounts of the materials vary.
2 3	Students explore how rocks break into smaller pieces through physical and chemical weathering.
4	Students go outdoors to explore and compare properties of local soils.
5	Students use stream-table models to observe that water moves earth materials from one location to another.
6 7	Students use stream-table models to investigate the variables of slope and water quantity on erosion and deposition.
8	Students look for evidence of erosion and deposition outdoors.
9	Students think about what happens to sediments over long periods of time as sediments layer on top of each other.
10	Students build a model of a landform of Mt. Shasta. They use the model to make a topographic map.
11	**Research Lesson:** Students will connect topographic maps to 3D models of 6 landforms. Using flashlights to cast shadows of the 3D models, students will find the profiles of the landforms. After removing the 3D models, students will connect the topographic maps to the profiles.
12	Students learn about volcanoes; they use the topographer's tools to analyze the impact of the Mt. St. Helen's eruption.
13	Students are introduced to processes that cause rapid changes to Earth's surface: landslides, earthquakes, floods, and volcanoes.
14	Students focus on earth materials as renewable and nonrenewable natural resources.
15	Students learn the importance of earth materials as resources by making a stepping stone out of concrete.
16	Students go on a schoolyard walk to find objects and structures and consider what natural resources were used to construct them.

10. **Design of the Unit and Lesson**

a. Science

As we've implemented this unit, we've focused on following the unit as planned in the FOSS teacher guide. When we looked at the standards across the grade levels, we noticed that the fourth grade standard builds on work from second grade and sets the stage for the fifth grade standards. The 3D landform models were built from topographic maps of six different landforms. We expect students will have two means for matching the landforms to their topographic maps: (1) noticing that the outline of each layer of the 3D model follows the same curvatures as the contour lines on the topographic maps and (2) that the number of layers on the 3D model correspond to the number of contour lines on the map. We expect that students will be able to notice that the "bumps" in the profile of the landform match the "bumps" in the landform itself. The students will be able to identify the topomap to the profiles by attending to the closeness of the contour intervals on the maps. When contour intervals are close to each other, the slope of a landform is steep. When the contour lines are far apart, the slope of a landform is gradual.

b. Cognitive Demand

For the research lesson, we made a significant change, as compared to the FOSS teacher guide. When we studied the teacher guide for this lesson, we noticed that the directions in the teacher guide led the students through a set of step–wise procedures to generate a profile from a topographic map. We thought the students could learn to follow the steps, but we were concerned that even by doing so, they may not understand conceptually what a profile is. Therefore, we made efforts to raise the cognitive demand by using shadows to help students understand profiles conceptually and link these profiles to the 3D and the topographic maps. We expect some students will be able to notice patterns between the profiles, topographic maps, and the 3D models. We also raised the cognitive demand by making sure that the size of the landform models was larger than the size of the topographic maps, making it so that students could not match them by fitting the landform inside the lowest contour line on the map.

c. Equity & Access

This lesson maximizes students' access to content by providing all students with an opportunity to work in small groups to communicate with each other about their thinking about the correspondence between a 3D model and a topographic map. Additionally, students need to work together in order to generate a profile of a landform. Each group of students is provided with the same set of 6 models and 7 topographic maps. This should support them in coming to agreement about the match of profiles to the maps. Small group and whole class discussions allow all students access to each other's thinking and to draw comparisons between ways to talk about the models, profiles, and maps.

d. Agency, Identity, and Authority

While designing the lesson, we thought carefully about how to make sure the scientific work of the lesson resided with the students, rather than the teacher, to the greatest degree possible. This principle guided us as we transformed the lesson away from a step-wise procedure and toward great student reasoning. The students are presented with a series of maps and landforms they have not had previous experience with. The Mt. Shasta model, which they have had previous experience with, will allow application of previous lessons to this one. The teacher's job in the lesson is to ask questions to help students articulate the features of the models, maps, and profiles that help them make the connections between these representations.

e. Assessment

The use of science notebooks is an essential feature of the overall unit and this lesson. Students use the notebook to record the date, the focus question, observations, and answers to the focus question. We structure our answers in a claim/evidence framework. With this lesson structure, the teacher will constantly be checking on students' thinking as they use the models, interpret the maps, and build the profiles. The lesson is focused on the students' reasoning, rather than the teacher's reasoning. Therefore, the students' reasoning should be visible as they work to solve the problem.

11. **Research Lesson Plan**

Focus Question: How do profiles of landforms relate to topographic maps?

Steps, Learning Activities Teacher's Questions and Expected Student Reactions	**Teacher Support**	**Assessment**
1. Introduction Teacher begins the lesson by following a common procedure used in the classroom. Students will glue their focus questions in the science notebooks, add the date to the entry, and add the entry to the table of contents. Class will discuss the focus question.		
2. Connecting to the previous lesson Students will compare the model of Mt. Shasta to its topographic map.	Ask: If the model was smaller, what other ways would we be able to match the foam mountain map to the model? Accountable talk: How do you know they match? What are some other ways it matches besides the numbers on the layers?	How do students relate the Mt. Shasta model to its map?
3. New exploration for evidence Direct students to the small maps and the foam models.	Ask: How do we match the 3D models to the small topographic maps? Accountable talk: How do you know they match? What is your evidence for your match?	How do students relate the 5 models to the 6 maps? What process do students use to reach consensus?

4. Initial recording Once consensus is reached, each student will choose 2 maps. They will paste these in their notebook and shade the maps to match the color of the model.		
5. Building the profile Each group of 3 will draw a color word out of the envelope. This is the 3D model they will build a profile of.	Teacher will explain how to use the light, set the model on the stand, and use the marker to create the profile. (Check orange – make sure they don't choose a profile that highlights the corner.	How do students rotate the model to determine the profile they want to record? How do they talk about the shadow and its relationship to the model?
6. Match the maps to the profiles With a new set of maps, students will match their maps to the profiles.	As students study the profile and their map, teachers will ask them questions to articulate how the maps match the profiles.	How are students making sense of the profile and connect it to the map?
7. Closure Return to desk, open science notebook, answer focus question.	Ask questions to assist students in describing how they knew how match the profile to the map.	How are students writing? How well does their writing represent their discussion?

12. **Evaluation**