Sequence of Lesson for An Introduction to The Scientific Process

1. Preclass video: Students view *The Scientific Process* and answer related questions in an online quiz (for example see https://geosciencevideos.files.wordpress.com/2015/06/scientificprocessquiz.pdf).
2. Class begins with a review of learning objectives from video and class lesson (slide 2).
3. Students answer multiple choice questions and short exercises (e.g., slides 3, 4) related to video content to allow instructor to confirm comprehension.
4. Instructor makes presentation on "doing science". Presentation of slides is interspersed with short activities (e.g., conceptests, think/pair/share). Wegener's continental drift hypothesis used as an example.
5. Final part of class has students divided into small groups to read and discuss news articles about geoscience and identify observations, hypotheses, predictions (slides 5,6); a final question (slide 7), a reflection exercise (slide 8), and review of the day's learning objectives.

1

Learning Objectives

Learning Objectives of the Video *The Scientific Process*

1. I can write a definition of the term "science".
2. I can compare and contrast data and interpretations.
3. I can summarize the components (observations, hypotheses, & predictions) of the scientific process.

Learning Objectives of the Related Class Lesson

1. I can explain how geoscientists use repeatable observations and testable ideas to help guide critical decisions
   a) I can explain Wegener's continental drift hypothesis and his supporting observations.
   b) I can explain why some scientists did not agree with the concept of continental drift.
   c) I can describe the reasons behind the development of the "land bridge" hypothesis and identify observations necessary to falsify it.
2. I can identify the differences between observations, hypotheses, and predictions in multiple scenarios.

2

LO: I can compare and contrast data and interpretations

How many of the following statements represent qualitative data?

- The crater is 400 meters in diameter.
- The crater is made of igneous rocks.
- The rocks in the crater are mostly dark green in color.
- The crater is 135,000 years old.

A. 1
B. 2
C. 3
D. 4

3

LO: I can compare and contrast data and interpretations

Devil's Postpile, Mammoth Mountain, CA

Patterned ground, Katmai National Park, AK

1. What observations can you make about the rocks at these locations?
2. What are some examples of the types of data you could you collect?

What are some possible interpretations of how these features formed?

From Earth Science Picture of the Day
http://epod.usra.edu/blog/

4

LO: I can identify the differences between observations, hypotheses, and predictions.

Hypothesis, observation, prediction

Activity #1: Size of People Scientific Method Study

Read the article "*Study: People Far Away From You Not Actually Smaller*"

- Summarize the principal **hypothesis** under investigation
- Explain how it was tested
- Identify a **prediction**
- Identify one or more **observations** used to evaluate the accuracy of the prediction

This activity is built around a humorous article published in *The Onion*. You can find the article here: http://www.theonion.com/article/study-people-far-away-from-you-not-actually-smalle-33594

5

LO: I can identify the differences between observations, hypotheses, and predictions.

Hypothesis, observation, prediction

Activity #2: Read one of two articles:

- *Drought Conditions in California are Causing Severe Subsidence*
- *Epic Drought in West is Literally Moving Mountains*

Consult with others. Consider the following:

- What is the principal **hypothesis** under investigation?
- What type of data was collected?
- What **prediction** could be made regarding this study?
- Can you identify one or more **observations** needed to evaluate the accuracy of the prediction?
- Class discussion to compare and contrast findings from each article. Can both articles be correct? Explain.

This activity is built around two articles from the following sources:

- http://www.climatecentral.org/news/epic-drought-in-west-is-moving-mountains-17924
- http://www.natureworldnews.com/articles/16205/20150823/drought-conditions-california-causing-severe-subsidence.htm

6

Science involves making observations and forming hypotheses. *Which of the following statements is more accurate?*

A. Observations are only as good as the hypotheses on which they are based.

B. Hypotheses are only as good as the observations on which they are based.

7

Reflection Exercise

1. **Look over** your notes and **write** a brief description of the scientific process involved in geological investigations.
2. **Answer** the following:
   a) What was the most useful thing you learned today?
   b) What remains the most confusing concept?
3. Be prepared to share.

8