



Broadening Research Interest in Geoscience, Habitat, and Technology (BRIGHT)

Investigation 2: EVALUATING EVIDENCE

Grades 9-12

Time requirement: 1 hour, 30 minutes

Next Generation Science Standards (NGSS)

Science and Engineering Practices

Obtaining, Evaluating, and Communicating Information

- Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

Disciplinary Core Ideas

Earth and Space Science

- ESS2: Earth's Systems
 - ESS2.E: Biogeology
 - The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.

Crosscutting Concepts

Science is a Way of Knowing

- Science distinguishes itself from other ways of knowing through use of empirical standards, logical arguments, and skeptical review.

OVERVIEW

Students engage in a short game-like exercise to evaluate the trustworthiness of sources. Based on the ideas generated during that exercise, the group compiles a list of criteria or questions used to evaluate claims and sources.

Students use the list of questions while doing small group research. They have a short amount of time to answer a question and develop a short presentation on the topic for the group. Students reflect on their process of sifting through online material to answer research questions and generate new questions.

LEARNING OBJECTIVES

Students will be able to:

- identify criteria to determine whether sources or claims are trustworthy.
- apply criteria and questioning techniques to evaluate sources of information online.
- develop a visual presentation and present it to peers.

INSTRUCTIONAL APPROACH

The instructor should establish a safe, collaborative, and value-neutral space to share ideas, and assist students in doing so. Evaluating the strength of evidence or trustworthiness of sources can be controversial; emphasize objectivity and value-neutral feedback for self and others. There is not one correct ranking of trustworthiness; different responses may prompt questions, discussion, and feedback.

MATERIALS

- Sets of source sticky notes, 1 per group of 3 students
- Copies of *Can You Believe It?*, 1 per student
- Computers, 1 per group

ACTIVITY

Setup

1. Ensure computers have access to internet and Google Sheets or Powerpoint.
2. Make a set of source sticky notes for each group of three students. On each sticky note, write one of the following sources: Wikipedia, parent, politician, personal observations, science textbook, scientist who has been studying a subject for 20 years, government website.
3. Make copies of Can You Believe It?
http://annex.exploratorium.edu/evidence/assets/seven_questions/Can_You_Believe_It.pdf

Investigation

1.5 hours

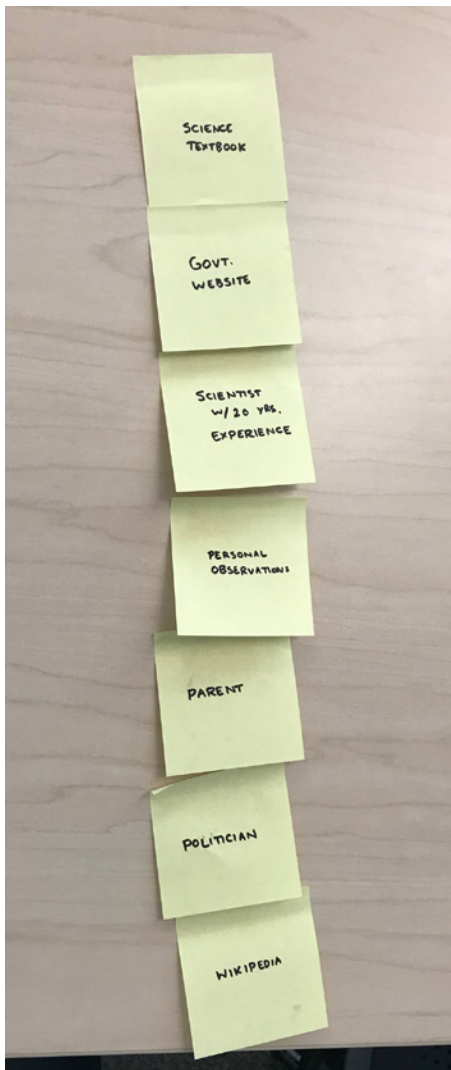
Evaluating evidence

45 minutes

1. Share a funny example of fake news, e.g., <http://www.sciencealert.com/no-that-s-not-actually-a-photo-of-a-beluga-whale-and-a-seal-hugging>; https://www.washingtonpost.com/news/the-intersect/wp/2017/06/28/a-seal-didnt-hug-a-beluga-whale-but-we-all-wanted-to-believe/?utm_term=.6895d825abc7.

Ask students:

- *How can we determine whether a source is trustworthy?*
2. Tell students that not all evidence is created equal and we are going to brainstorm our own criteria for evaluating the strength of evidence.
 3. Divide students into groups of three and pass out a set of sticky notes to each group (one source is written on each sticky note, including Wikipedia, parent, politician, personal observations, science textbook, scientist who has been studying a subject for 20 years, government website). Prompt students to rank the sources from least to most trustworthy.



Student ranking of sources, from most trustworthy (top) to least (bottom). Photo by Suzanne Perin

4. When they have finished ranking, ask groups to compare their order to those of other groups. If differences arise, ask students to explain their reasoning. As a large group, brainstorm and record a list of questions that arose or criteria that emerged.
5. Ask students:
 - *Do you rely on Wikipedia for information?*
 - *What kinds of search results do you get when you Google “Wikipedia accuracy”?*
 - *How could we determine whether to trust the findings from these studies?*
6. Pass out the Exploratorium’s Can You Believe It? sheet with seven helpful questions for evaluating evidence (which folds into a booklet for students to keep). Remind students that it is always important to question and bring a critical eye to evidence. Because we are all non-experts in something, these questions can be a helpful starting point when researching new topics. Compare the seven questions below with those generated by the group previously.
 - *What’s the claim?*
 - *Who says?*
 - *What’s the evidence?*
 - *How did they get the evidence?*
 - *Is there anything (or anyone) to back up the claim?*
 - *Could there be another explanation?*
 - *Who cares?*
 - *Can you believe it?*

Research and presentations

45 minutes

1. Divide students into groups of four. Each group gets a biogeological topic to research using online resources.

Example research topics and questions:

- Life cycle or annual cycle stages, and associated habitats, of a species of interest
 - *What do ___ do during each stage, and in what habitats (define each stage and consider associated constraints and adaptations)?*
 - *What challenges do they face? What adaptations do they need to do so?*
 - *What do ___ eat? (and how do we know?)*
 - *What eats ___? (and how do we know?)*
 - Adaptations and habitat of a species of interest
 - *What are characteristics of ___ environments and what adaptations make ___ well-suited to these environments?*
 - *How might habitat loss or change occur and how are ___ affected?*
 - *How are ___ populations doing in ___?*
 - *How might climate change impact ___?*
2. Let students know that they will have twenty minutes to research and develop a five-minute, five-slide presentation using Google Sheets or Powerpoint. Remind them that, although they will work quickly, they need to keep the criteria for evaluating evidence in mind. If they are unsure of a source, encourage them to ask each other or instructors whether they know anything about that particular source. Ask them to acknowledge their sources of information in their presentations.
 3. When each group presents, encourage the audience to ask constructive follow-up questions of their peers; instructors should wait to ask questions until students have done so first. Facilitate questions and answers to clarify or extend content covered in the presentations. Prompt each group to reflect on the sources of information used during the research process.
 - *Where and how did you start the research process?*
 - *Were there sources you rejected? Why?*
 - *What sources did you end up using and why did they appear to be trustworthy?*

Extension

30 minutes

1. Give groups more time to discuss their rankings with each other; how did they differ and why?
2. Students use the criteria developed in this investigation to research news coverage (national, state, local) related to a species and habitat of interest (e.g., salmon in the Chena River or seals in Tracy Arm, Alaska). Ask students to spend 15 minutes researching news coverage of the species and habitat in their table groups.
 - *What kinds of topics related to ___ do news outlets cover?*
 - *Who is concerned about ___ or ___ habitat and what kinds of concerns do they have?*
 - *How are ___ populations doing this year?*
 - *What are concerns relevant to people in ___?*
3. Ask students to leverage what they know (and may have just read) about the locality of interest to consider whether it is a healthy habitat for the species.
 - *What habitat characteristics are important to ___ at different life history stages?*
 - *What kinds of human impacts might influence the habitat over short and long timescales?*
 - *How could we evaluate ecosystem health? What variables could we observe and measure in the habitat?*
 - *What questions are scientists asking about ___ and their habitats?*
4. In groups, students draw diagrams connecting life history stages to habitat characteristics. Small groups then share their diagrams with the larger group.

OTHER RESOURCES

Can You Believe It?: <https://www.exploratorium.edu/blogs/spectrum/can-you-believe-it>
<http://annex.exploratorium.edu/evidence/>

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