

**TITLE: Argument From Evidence**

**Subtitle: Assessing argumentation using the topic of “fracking”**

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**Field tested with:** 11<sup>th</sup> grade social science students, Watsonville High School, Watsonville, CA (Winter 2014)

**Module Type:** Classroom research and debate activity

**Duration:** 30 min. lecture, 30 min. individual research activity, and 30 min. class debate (plus 20 min flex time) in 1 hr. 50 min. class session

**Key materials:**

- Fracking research and debate worksheet (1 per student)
- Computer for individual research (1 per student)
- Pen or pencil to record lecture notes on worksheet (1 per student)

**Concepts:** environmental and economic impacts of extractive development, how stakeholders use competing facts in natural resource management

**Skills:** how to summarize the key points of an argument, how to question the validity and subjectivity of information, how to summarize and convey a broad set of information in a succinct fashion

**NGSS DCI:** LS2: Ecosystems: Interactions, Energy, and Dynamics

**NGSS Practices:** 2. Developing and using models; 8. Obtaining, evaluating, and communicating information

**NGSS CCC:** 1. Patterns; 6. Structure and function

**Overview:**

This project is an opportunity for students to learn:

- How community, government and corporate roles help to determine opinion
- How to summarize an issue into a set of key points
- How to sift through information to find factual basis of an argument

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## Background for Teachers

**Why this matters:** Students living in rural communities impacted by ongoing and proposed extractive mineral development (fossil fuels and mining) will gain a greater appreciation and understanding for how different segments of society (government, corporate, and community) produce information to serve their own interests and how 'factual' information is often contested between these groups.

**Assumed background:** Prior knowledge about civic government, the role of local voting initiatives, and the relationship between corporate, government, and community interests is needed for this module. This module can serve as a social science 'add-on' activity for physical science-based classes that are focusing on environmental impacts from natural resources.

### Special context:

Hydraulic fracturing, otherwise known as “**fracking**”, is an extraction technology that increases recoverability of traditional oil and gas reserves. Fracking wells are drilled 1-2 miles beneath the surface and then another 1-2 miles horizontally at the depth of the shale formation. Proprietary chemicals, sand, and water are pumped down the concrete-lined wells at high pressure to fracture the shale and release excess hydrocarbons (oil and gas) which are then pumped up to the surface. The release of these chemicals into the groundwater as well as the excess gas and contaminated surface water released from pumping pose serious **environmental impacts** and human health impacts.

The use of fracking is increasing throughout the United States in places like North Dakota, Pennsylvania, and Texas. Boomtowns in these states have emerged with increased job opportunities, however many of these small towns cannot handle the sudden population growth and are faced with long-term **economic impacts** such as higher crime rates, insufficient social services, and a push out of existing livelihoods like farming and ranching. Fracking has been used to increase extractive recoverability in existing California oil and gas wells for over 50 years but only recently have proposals been put forth to develop new well fields from the Monterey shale basin, stretching from Los Angeles to Monterey and throughout the Central Valley. Extractive development like fracking highlights competing facts about the environment between different **stakeholders** in the community, government and corporate interests.

### Scaffolding supplements:

- CBS SF Bay Area: [www.youtube.com/watch?v=EO9OzELftE](http://www.youtube.com/watch?v=EO9OzELftE)

## Module Description

### Materials:

- Fracking research and debate worksheet (1 per student)
- Computer for individual research (1 per student)
- Pen or pencil to record lecture notes on worksheet (1 per student)

### Preparation:

- For the debate you will need to position 6 chairs at the front of the room (3 on each side) while students are pursuing individual research on computers



### Timeline:

1. Lecture - Background concepts and keywords (30 min.)
2. Activity Introduction – Explanation of individual research activity (5 min.)
3. Individual Research – Students record facts from assigned websites (30 min.)
4. Debate Introduction – Explanation of debate format (5 minutes)
5. Debate – Three students will advocate for environment and three for economy (30 min.)

### Starting Point For Inquiry:

Students will take notes throughout a lecture designed to get them to think about the different facts used by community, government, and corporate stakeholders who are pro-environment and pro-economy. They will be assigned a role and asked to make a prediction as to whether this stakeholder is pro-environment or pro-economy. Students will then go to a website created by the group who they are role-playing and be asked to find facts that support this prediction.

### Detailed Procedure:

Step 1. Students will actively listen and take notes during the lecture. They will pay attention to writing down keywords and remember to take notes about facts and sources that can be used during class debate.

Step 2. After the lecture each student will be assigned to a stakeholder group: community, government, or corporation by asking them to count off a number 1 through 3. For the purposes of the debate students may choose to pick a more specific role to play within these larger groups, such as ranchers or city residents (community), city or state politician (government), fracking company representative or local business (corporation).

Step 3. Students will independently research facts to support their assigned role based on the claim that their role is either pro-economy or pro-environment. This inquiry-based research should utilize the three websites provided, each of which is from a different stakeholder group though online news sources can be used to supplement this information.

Step 4. Six chairs will be set up at the front of the classroom, three on either side, where one side is pro-environment and the other pro-economy. The instructor will ask one student from each stakeholder group to volunteer for each side. Each student will be given an opening chance to speak, pose a question for the other side, and given time for a rebuttal. The rest of the members from each stakeholder group in the class may raise their hand when they have a fact, question or rebuttal that is relevant and speak in lieu of the designated debater. The instructor will help students brainstorm pros and cons of fracking by drawing a three-circled Venn diagram on the board which can be filled in with the competing economic and environmental facts used throughout the debate.

### Assessment Methods:

Students will be assessed on their completion of the worksheet which reflects their participation in both the individual inquiry and group debate. Teachers may consider giving extra credit to students who participate as the representatives in the debate.

### Possible pitfalls:

Students will need to be supervised while conducting independent research on computers so as to understand the process of role playing as they're deriving the facts for their given group (community, corporate or government) which is either pro-environment or pro-economy. It will



be important to make sure all the students participate with a unique fact from their assigned role since the debate will take place between a representative sample of students who will sit at the front of the class. Lack of involvement can be overcome by asking the representatives to go back to their stakeholder caucus and poll their group members for further facts.

### Glossary:

**“Fracking” (Hydraulic Fracturing):** The process of injecting liquid at high pressure into a vertically (and often horizontally) drilled well in order to fracture the shale formation and extract oil or gas. Fracking often involves hundreds of proprietary chemicals which are injected into a well to increase recovery, however the chemicals themselves cannot be recovered and remain within the groundwater in perpetuity.

**Environmental Impacts:** Environmental impacts associated with energy extraction can take place during the development of a mine or well when construction of infrastructure degrades the environment, during the operational phase when lack of regulations allow groundwater and air pollution to take place or post-closure when monitoring is often inexistent.

**Economic Impacts:** The economic impacts of energy extraction can be segmented into short-term and long-term impacts. Short-term impacts are often positive such as direct and indirect increases in employment and rents from oil leases, however crime and lack of medical or social services can also be issues in the short-term, especially in small communities which cannot accommodate the increase in population. In the long-term a mine or oil field will inevitably reach the end of its life cycle and with the associated economy will bust, leaving high unemployment and often an inability for community members to engage with previous livelihoods (such as farming or ranching) because the water resources that these economies rely on have been polluted.

**Stakeholders:** A person with an interest or concern about a particular issue. In terms of natural resource management, coalitions of community, corporate and government stakeholders will often band together on an issue with common facts and opinions based on their own livelihood or economic position.

### NGSS Standards Addressed

#### Disciplinary Core Ideas

HS-ESS3 Earth and Human Activity

ESS3.A: Natural Resources

#### Science & Engineering Practices

7. Engaging in argument from evidence

8. Obtaining, evaluating, and communicating information

#### Cross Cutting Concepts

4. Systems and system models

### Guide to supplemental materials

#### Lectures:

Frackingdebate\_lecture.ppt

#### Labs (or Activities)

Frackingdebate\_worksheet.doc

