Using Issues as a Context for Teaching Science Content and Inquiry

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What is an Issue?

• A point or matter of discussion, debate, or dispute
• A matter of public concern

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Goals of issue-oriented science

- To engage all students in the process of learning science
- To encourage and prepare students to use scientific evidence to make decisions
- To help educate tomorrow's citizens about the application of science to everyday life

Issues-based Science

- Provides a context for science content, science process, and nature of science
- Requires the integration of science concepts and processes with social constructs and practices
- Issues are often relevant to students since life in the 21st century is closely linked with science & technology

(Sadler, Barab, Scott, 2007)
Extracting Metal From a Rock Activity

• This is part of a series of activities that looks at aspects of materials usage with a focus on sustainability
• Conduct the modified activity with a partner and discuss what scientific content and processes could be learned using the activity

Potential Science Content & Process Outcomes

Content
• Chemical equations
• Single replacement reactions
• Metal reactivity
• Metallurgy

Process
• Various laboratory skills
Potential Issues

• Is there enough of this resource?
• What do we do with the waste?
• What are the energy and pollution implications of this process?
• Are there alternative materials that can be used? What are the advantages and disadvantages of using them?

Using Issues to Teach Science

• Issues can be focused at various levels
  – Personal
  – Community/societal
  – Global
Examples of personal issues

– Would you choose to buy a mined or manufactured diamond?

– Would you take this new medicine?

– Would you choose to drink bottled water or tap water?

– Which car would you buy if your primary concern was safety in a crash?

Examples of societal issues

• What space missions should be funded from a limited budget?

• What is the most effective way to reduce heart disease?

• How should society encourage energy efficiency?
Topics related to Global Issues

• Climate change
• Resource use (also community level)
• Pollution (also community level)
• Coral bleaching (also community)
• Fisheries (also community and personal)

Criteria for Choosing Issues

The strongest issues:
• Require knowledge and understanding of important scientific concepts and processes
• Require an application of relevant scientific evidence
• Engage diverse groups of students
• Are complex enough to foster discussion and debate (Is there more than one solution or response?)
Other Considerations

However, you might also include issues that:

• Are in the news
• Are especially relevant to the age group
• Illuminate the difference between the evidence that science can provide and the social aspects of the decision

Some ways to incorporate issues

• Lab or activity
e. g. Tasting or testing different water samples
• Analyzing data
• Reading and discussion
  – Stories about events that have happened
• Role plays/skits
  – Scripted, typical conversations
  – Different roles with different perspectives
• Debates
• Position statements
Introduce an issue with a scenario

Introduce an issue with a cartoon
Introduce an issue with news articles or headlines

Assessing Issue-oriented Science

• Content
  – Understanding Concepts
• Process
  – Organizing Data
  – Designing Investigations
  – Analyzing Data
• Making Evidence-Based Decisions
  – Recognizing Evidence
  – Evidence and Trade-offs
• Communication
  – Organizing Scientific Ideas (SI)
  – Communication Skills (CS)
• Group Interaction

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Assessing Issue-oriented Science

- The issue should not have a simple solution
- Aspects of the issue should require students to evaluate claims and evidence
- There should be opportunities for students to identify trade-offs and support and explain their reasoning

Trade-offs

- Since an issue by definition does not have a simple solution there will be trade-offs associated with every resolution to an issue
- A trade-off can be described as giving up one advantage to gain another
- Evaluating the trade-offs associated with aspects of an issue is an effective and engaging way to involve students in discussion and debate
Scoring Guide: Evidence and Trade-offs

<table>
<thead>
<tr>
<th>Level 4</th>
<th>Student accomplishes Level 3 and goes beyond in some significant way.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 3</td>
<td>Student compares options using accurate and complete evidence and takes a position supported by the evidence. Student describes trade-offs of his/her decision.</td>
</tr>
<tr>
<td>Level 2</td>
<td>Student discusses one or more options using accurate or relevant evidence and takes a position supported by the evidence BUT reasoning is incomplete and/or part of the evidence is missing.</td>
</tr>
<tr>
<td>Level 1</td>
<td>Student takes a position BUT provides reasons that are subjective, inaccurate, or nonscientific.</td>
</tr>
<tr>
<td>Level 0</td>
<td>Student’s response is missing or irrelevant.</td>
</tr>
</tbody>
</table>

Main Points

- A topic isn’t an issue. Issues should involve questions.
- The issue should not have a simple solution
- Aspects of the issue should require students to evaluate claims and evidence
- There should be opportunities for students to identify trade-offs and support and explain their reasoning
- To be most effective the issue should drive the learning of content and process skills (not merely be an add-on)
- Time! Issues are inherently complex and to study enough content and to develop the reasoning skills requires time, structure, and intent.
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SEPUP website
(for this presentation and other information)
http://www.sepuplhs.org

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