Dialogue: Changing the Game of Classroom Discussion

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There is increasing consensus that content and language instruction should be dialogic (more effective).

Rather than receiving lecturers (monologue), students need to engage in dialogue:
- Teacher questioning (not IRE!);
- Classroom Argumentation
- Peer learning and group work.
Next Generation Science Standards

Eight essential practices of science and engineering:

1. Asking questions
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

3 out of 8 are dialogic!!!!
NGSS Practice 7: Argumentation

“Argumentation is a process for reaching agreements about [best] explanations.”

In Grades 9-12, students should:
- Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.
- Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence, challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining additional information required to resolve contradictions.
In the 1940s, scientists debated whether the genetic material was made up of protein or DNA:

“Of course there were scientists who thought the evidence favoring DNA was inconclusive and preferred to believe that genes were protein molecules. Francis (Crick) however, did not worry about these skeptics. Many were cantankerous fools who unfailingly backed the wrong horses. One could not be a successful scientist without realizing that, in contrast to the popular conceptions supported by newspapers and mothers of scientists, a goodly number of scientists are not only narrow-minded and dull, but also just stupid. (Watson 1968, 13)”
The Root of the Problem

- **Myth of science objectivity** (McComas, 1996): scientists are particularly objective professionals and science is characterized by complete objectivity (bias-free).

- To argue scientifically is to argue objectively:
  - focused on facts (not people)
  - relationships are unimportant
  - no need for politeness (ruthless objectivity)

- The result: **lots of communication problems**!
Let’s Undo the Myth

- Arguing is not as simple and straightforward as commonly assumed.
- Even scientists struggle to argue objectively and intelligently!
- The emotional challenges of argumentation can not be ignored.
- We need to better understand what argumentation is as well as its demands (thinking and emotionality).
Interest in argumentation is not novel.

Its study dates back to Aristotle.
What is argumentation anyway?

Some definitions:

- the **art of persuading others** to think or act in a definite way, orally or in writing (Ketcham, 1917)
- the **process of proving or disproving a proposition** (MacEwan, 1898). Purpose: to establish truth or combat error in the mind of another.
- **reason giving** in communicative situations by people whose purpose is the justification of acts, beliefs, attitudes, and values (Freeley & Steinberg, 2008)

**Argumentation ≠ Argument**

argument is a product within the argumentation process
What’s argumentation anyway?

Toulmin’s Argument Structure

- **Claim**: a stance or position
- **Data**: empirical evidence
- The claim is justified (**warranted**) on the basis of available evidence.
- **Backing**: scientific principle or concept underlying the warrant.
Which one is a scientific argument?

- It’s wrong to experiment on animals.  
  Moral Claim

- I don’t believe in evolution because I’m a Christian.  
  Value Claim

- Global warming is true since the icecaps are melting.  
  Scientific Claim
What makes an argument scientific?

Global warming is true since the ice caps are melting.

- **Evidence**: Melting ice caps
- **Claim**: Global warming
- **So**
- **Warrant**: The melting is being caused by the higher atmospheric temperatures

**Scientific arguments** -- claims based on evidence (not opinion, family values or personal values)
A few notes:

- In casual conversation, argumentation is informal:
  - Argument components/structure are mostly implicit;
  - enthyemematic argumentation

- Argument analysis seek to:
  - Identify argument components
  - Make the rhetorical structure explicit
  - Extract the essence of arguments.
A few notes:

- **Toulmin’s model is simplistic:**
  - focused on the structure of a single argument (micro-level).
  - can be used only for the most simple arguments.

- **Real-life argumentation is much more complex:**
  - **Multiple arguments** are presented
  - Speakers attack different parts of argument, not just the claim (**goes beyond rebuttals**)
  - Speakers even can counter attack rebuttals!!! (aka, counter-rebuttals and refutations)
  - Additional argument components exist.
Case-based: students argue in response to dilemmas.

Typical format:
- debates at the end of instructional units (projects)
- role-playing (town hall meeting, mock trials…)

Goal: Students have to select and defend a course of action.
- Short narrative stories with characters, dialogue and a plot;
- Open or close-ended;
- Realistic and real-life.
Classroom Argumentation

- Students are not explicitly taught what constitutes scientific argumentation.
- Teachers simply engage students in debates with unclear rules of participation.
- Disrespect, fallacies, too emotional…
- Lots of problems!!!

Arguing to learn without learning to argue
Problematic Patterns

- **normative reasoning** (arguments based on social norms);

- **casuistical reasoning**:
  - confusion between hypothetical and actual situations
  - focus on the veracity of dilemmas rather than deciding on a particular course of action;

- **fallacious reasoning**:
  - inability to distinguish between evidence- and opinion-based arguments
  - fusion of personal beliefs with scientific facts,
  - ecological misconceptions,
  - simplistic and low-quality argumentation).

- claims **unsupported by data**, **poorly articulated claims**, and **no rebuttals** (Zeidler, et al., 2003);

- overlook **disconfirming evidence** and rely upon **uncritical** statement of value preferences (Hogan, 2002).
Informal Fallacies

**Definition**: (persuasive) arguments that violate the rules of logic.

**Major Categories**:
- fallacies of relevance (logically irrelevant premises)
- fallacies of ambiguity (ambiguous words or terms – shifts in meaning)
  - Example: “Evolution is just a **theory**”

Informal Fallacies

- **Ad hominem argument** – attacking a person’s character or credibility. Example: “David’s objection to the nuclear power plant should be dismissed entirely, since he never knows what he is talking about.”

- **Appeal to popularity** – arguing that most people treat a claim as truth or acceptable. Example: “Evolution? Of course evolution is a proven theory! Everyone believes that; so, it hardly seems possible not to believe it.”

- **False dilemma** – argument that assumes only two possible sides. Example: “Well, I guess if Darwin’s theory of evolution is wrong on these issues, then the creationist view must be right.”

- **Appeal to authority** – using the opinion of a famous scientist or religion to justify a claim. Example: “The Bible says so.”
Agonism (Tannen)

- Debates and argumentation tend to foster **agonism**:
  - Combativeness
  - Polarization
  - Aggression (attacks)
- **Unproductive** approach to problem-solving and decision-making
- Fosters **negative feelings** (anger, defensiveness, etc.)
- “Battle/War” metaphors should be avoided
What lesson can be learned?

- Students need to be prepared to argue scientifically.
- Students need to learn to argue before arguing to learn.
- Argumentation skills should not be presumed.
- Learning science/math through argumentation requires guidance and scaffolding.
- Argumentation needs to be taught explicitly.
What can you do?
Suggestion 1

- Avoid using the word “debate” (too combative).
- Frame argumentation dialogically by calling it:
  - “science dialogue”,
  - “dialogical argumentation”,
  - or simply a “discussion”.

The power of words in shaping expectations is too often overlooked.
Suggestion 2

- Have students analyze the argument structure of texts and videos (modeling).

Traits of strong and weak arguments.

<table>
<thead>
<tr>
<th>Strong arguments</th>
<th>Weak arguments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use three or four reliable sources</td>
<td>Use only one or two reliable sources or use only unreliable sources</td>
</tr>
<tr>
<td>Discuss the counterarguments</td>
<td>Do not reference counterarguments</td>
</tr>
<tr>
<td>Refer to sources and evidence in the rebuttal</td>
<td>Refer to opinions in the rebuttal</td>
</tr>
<tr>
<td>Use clear and understandable language</td>
<td>Use unclear, incomprehensible language; copy language from a reference</td>
</tr>
</tbody>
</table>

Scaffold: first written texts then videos (oral argumentation is more difficult).
Suggestion 3

- Have students **agree or disagree with a statement**:  
  - The giraffe got its long neck by stretching for leaves at the top of trees.
  - A meteorite hitting the Earth caused the extinction of dinosaurs.
  - Frequent use of cell phones can cause brain cancer.
  - The table you are working on is mostly empty space.

*Scaffold:* from isolated sentences to texts (more difficult)

*Scaffold:* from analysis to production (from others’ to own arguments).
Suggestion 4

Use **starter sentences** to help students state their positions:

- “The statement argues that _______. I agree with the statement because _____.”
- “The statement contends that ________; however, I disagree with the statement because _____.”
- “On one hand I agree with the statement about _____ because _____ ;
- On the other hand, I disagree with it because ______.”
Provide **discussion questions:**

1. What types of evidence did the debaters use?
2. How did the debaters use evidence to support their arguments? Give specific examples.
3. Which debater had the stronger evidence? Justify your answer.
Suggestion 6

- Provide **writing prompts:**

**Writing prompt.**

My argument
1. My claim is __________________________
2. My evidence (data and warrants) is __________________________
3. Counter arguments (rebuttals) against my claim could be ______________
4. My evidence to refute the counter arguments would be ______________
5. I would persuade someone that doesn’t believe me by ______________
Suggestion 7

- Model how NOT to argue.

For example, introduce students to reasoning fallacies (see https://en.wikipedia.org/wiki/List_of_fallacies)

CIRCULAR REASONING

You started at your conclusion, so why go anywhere else?

Aka. tautology
Suggestion 8

- Go beyond rhetorical structures and also teach politeness and respect (how to disagree).
Arguing is an Art!

The purpose of argument, should not be victory, but progress.