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Using the study of argument to learn about industrial chemistry as students find claims and evidence in C&EN cover stories while Hillocks' Teaching of Argument Writing advocates the supporting of generalizations with concrete evidence

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P984: Using the study of argument to learn about industrial chemistry as students find claims and evidence in C&EN cover stories while Hillocks’ Teaching of Argument Writing advocates the supporting of generalizations with concrete evidence

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2014 Biennial Conference on Chemical Education
Grand Valley State University
August 3-7, 2014
S68: Argumentation in the K - 16 Chemistry Curriculum
Presider: Nicole M. Becker, Michigan State University
Senior level seminar course for

Chemistry and environmental engineering technology majors

“Industrial Chemistry and Environmental Regulation”

A fertile intersection of four content areas.

This area of inquiry provides breadth and depth.

The news factor provides context and immediacy.

Topic possibilities seem limitless.

Most of the learning is self-directed.

The selves must learn to make choices.
Performance Expectations

Learners select stories that contain sufficient data or chemical detail and reject stories that do not.

Learners read to identify data or chemical details in stories.

Learners identify and restate claims made based on that data.

Learners analyze the relationship of the way the data or chemical details support the claim.

Learners synthesize the claim with its impact upon facts, judgments, or policies.
My claim to you today:

The C&E News provides an accessible and rich archive of stories in which data and chemical detail may be found
to support instruction of content knowledge related to
Industrial chemistry
Environmental chemistry

As well as to support the analysis of arguments
Of fact, judgment, and policy related to
The Chemical Industry and
Chemistry of the Environment.
To select cover story: Browse covers either in hard copy or in the online “Cover Gallery”.

![Cover Gallery Image](image-url)
At first, students use the military memo scheme to familiarize themselves with the issue:

- Situation
- Mission
- Execution
- Command
- Support

And to organize five panels.

The sixth panel is title page and works cited combined.

What’s going on? What is trying to be accomplished?
What are the chemical details?
Who are the players?
Does it cost money, time, manpower?

Learners gain a familiar overview knowledge of the topic.
Meanwhile, Hillocks’ *Teaching Argument Writing* takes us from Aristotle to Toulmin.

Aristotle’s reasoning. His response to that problem was his *Rhetoric* (1991), the work long recognized as one of the most important texts in the subject that deals with arguments of probability of three kinds: forensic, epideictic, and deliberative, or, as noted earlier, what I like to call arguments of fact, judgment, and policy.

In the past two or three decades, colleges and universities have turned to a newer treatment of arguments of probability, that by Stephen Toulmin in *The Uses of Argument*.

**The Elements of Argument**

Toulmin’s basic conception of argument includes several elements:

- a **claim**
- based on **evidence** of some sort
- a **warrant** that explains how the evidence supports the claim
- **backing** supporting the warrants
- **qualifications** and **rebuttals** or counter arguments that refute competing claims.
After the SMECS presentations and
An introduction of argument concepts

Students re-present their cover stories
In new presentations.

The students must explicitly include the scientific details of
what is being claimed
and what evidence is being used.

The students must work to find
what data is included in the story and why?

C&E News articles are a rich resource for this task.

Examples follow.
The teachable moment: Fluorochemicals go short

Student reads article and repeats: “It bad, so stop using it. Use this instead.”

Why is it bad? Article states: Nearly all humans, and a large proportion of wildlife, are contaminated with environmentally persistent long-chain perfluoroalkyl compounds.

I asked her, “Do they have data?” She replied, “I don’t know.”

The data was there in the article, but I had to teach her to see what it was saying. She did not immediately see the difference in saying we suppose it could be, must be everywhere versus saying specifically someone has gone out and measured and reported back data in the literature that it is everywhere.
Why is this news? What science is behind the change? Using biodegradable plastic bags allows vegetable waste to be compostable. Chemistry specifics of the plastic, the bacteria, the enzymes.

Citation becomes transparent As the reporter and the scientist Have meaningful roles And serve the student’s purpose.
Why is this news?
Up until now, not Getting good biomass Conversion from
Wood to feedstock; But now... chemical details
Why is this important?
Now, locally.
Later, globally.

Zone of Mediterranean Sea
West of Italy
Thought to model expected
Changes in sea from
Climate change, especially
Thermal vents, acidification
Cover story about not having enough data
What about ... what we don’t know?
Safety is presumed.
Computational modeling and models of Structure and function can help reduce the backlog of untested molecules
C&E News articles are a rich resource for finding:
What makes this news? Why is this important? What is the science behind the news?

The membership of ACS is a very demanding audience. The C&EN reporters are worthy of the challenge. The opinions and editorials are clearly marked.

The resources help students recognize data and see its role in scientific argumentation.

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