Moving from a Danger Culture to a Safety Culture

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Today's Topics

1. Danger Cultures and Safety Cultures
2. The Connection between Safety Culture and Risk Assessment
3. The Emerging Lab Safety Paradigm
4. Connecting Chemical Safety and Information Literacy
My Lab Safety Education

• B.S. in geology in 1979 from Cornell University and 2 years as a lab tech in the soil sciences department there

• Moved to UVM as a lab tech and got a masters, then started the lab safety program there in 1985

• In 2011, I returned to Cornell for 3 years to focus on lab ventilation and I’m now CHO at Keene State in NH, which is a Predominantly Undergraduate Institute

• A question that arose in moving between these academic settings is: "What is the difference between training and education?"

Cultural impact is a key part of the answer.
A Danger Culture in Action

• On the day of the Deepwater Horizon explosion, the company held a ceremony on the rig celebrating 7 years without a lost time accident (a measure of personal safety).

• Investigations of the event indicated that Process Safety on the rig was neglected.

• The Chemical Safety Board investigation used this event to illustrate the differences between Personal Safety and Process Safety
Personal Safety and System Safety are (dis)connected by Risk Culture

- The idea of safety culture emerged in the 1980’s, in the aftermath of Bhopal and Chernobyl.
- In the early 1990’s, Arie Rip, a Belgian chemist turned sociologist, broadened the idea of safety culture to identify two types of Risk Cultures: Danger Cultures and Safety Cultures

From Silbey, 2014
Stages of Risk Culture
(remember that groups move in both directions)

DuPont's Bradley Curve

The Focus of the Risk Assessment Paradigm

Count of:
- Injuries
- Rework
- Defects

Danger culture
Safety culture

What factors move a group's culture in one direction or the other?
Let's talk about 3 (among many)
Cultural Factor #1: Organizational Complexity

Leads to:

- Varying understandings of "safety" by individuals and within subcultures
- Competing interests within the organization use safety as a bargaining chip
- Inequalities in power impact communication patterns within the group

This means that teaching "PPE as safety" does not educate for the next lab experience (cf. UCLA)

From Silbey, 2014
Cultural Factor #2: "Street" Perception of Risk

The National Research Council reports that STEM instruction often does not address the students’ prior knowledge... students end up learning the material as “isolated abstractions” and are unable to process the “big picture”.

A street scene, Keene NH
October, 2014

KSC Safety Students Survey
Cultural Factor #3: The Prevailing Paradigm

The Shared Technical Framework

Kuhn, 1962 *The Structure of Scientific Revolutions*
Signs of a Changing World View / Gestalt Shift

- The Chemical Safety Board is concerned
- The American Chemical Society is concerned (CA, CCS, CPT, CHED, CHAS among others)
- The National Research Council is concerned
What's Happening at the Student Level?

Blue = scores before labs began; Green = scores after lab ended

Development of an Assessment Tool To Measure Students’ Meaningful Learning in the Undergraduate Chemistry Laboratory

Kelli R. Galloway and Stacey Lowery Bretz*
Department of Chemistry & Biochemistry, Miami University, Oxford, Ohio 45056, United States
Student Interest in Chemical Health and Safety Issues

South Dakota State Chemistry Students

Keene State College Safety Students

Pre-Course Student Survey
In your opinion, how important is it for undergraduate chemistry majors to have an understanding of the fundamentals of toxicology?

Chemical Safety Awareness

- Boss aware of chemical hazards?
- You aware of hazards?
- Boss manages chemical hazards?
- You manage hazards?
- Concern about lab hazards?
- Toxicology importance
Shifting the Paradigm

The Shared Technical Framework

20th Century Risk Culture: Danger Culture focused on "zero incidents"

21st Century Risk Culture: Safety Culture focused on continuous improvement

Kuhn, 1962 *The Structure of Scientific Revolutions*
An Emerging Paradigm: RAMP -> aRAMPp -> iRAMPp

1. EHS Awareness
2. Recognizing Hazards
3. Assessing Risks
4. Managing Safety
5. Preparing for Emergencies
6. Protecting the Environment

**Good News:**
With small additions, this paradigm is *extensible* and *scalable* (requirements for EHS and community use)

**More Good News:** Using this paradigm requires information literacy as well as risk assessment knowledge.
Safety Information Literacy

South Dakota State Chemistry Students

Keene State College Safety Students

Pre-Course Student Survey
If you desire to find out more information about the toxic effects of a specific chemical, how would you proceed?

Where would you look for more information?

- No Answer: 5%
- Ask someone: 31%
- General literature: 14%
- Formatted info: 20%
- Google or other Internet source: 30%
# Teaching Information Literacy Alongside Chemical Safety

<table>
<thead>
<tr>
<th></th>
<th>Performance Level 3</th>
<th>Performance Level 2</th>
<th>Performance Level 1</th>
<th>Performance Level 0</th>
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<tbody>
<tr>
<td><strong>Awareness</strong></td>
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<tr>
<td>Defines research question/thesis</td>
<td>Student: Defines a specific research question/thesis/topic.</td>
<td>Student: Defines a research question/thesis/topic but scope is too broad or too narrow.</td>
<td>Student: Defines a research question/thesis/topic, but it is unclear or incomplete.</td>
<td>Student: Does not define a research question/thesis/topic.</td>
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<tr>
<td>Determines key concepts</td>
<td>Student: Identifies keywords that reflect the research question/thesis/topic and also identifies synonyms.</td>
<td>Student: Identifies keywords that reflect the research question/thesis/topic.</td>
<td>Student: Identifies keywords but some of them are off topic.</td>
<td>Student: Does not identify any keywords that describe the research/question/thesis topic.</td>
</tr>
<tr>
<td>Identifies types of information sources (books, peer-reviewed articles, data, etc.) specific to the research need</td>
<td>Student: Identifies multiple information source types to search for that are relevant to their research need.</td>
<td>Student: Identifies at least one information source type to search for that is relevant to their research need.</td>
<td>Student: Identifies information source types to search for, but none are relevant to the research need.</td>
<td>Students: Does not identify information source types to search for.</td>
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<td><strong>Assess</strong></td>
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<td>Student: Identifies multiple information resources in which to search that are relevant to their research need.</td>
<td>Student: Identifies at least one information resource in which to search that is relevant to their research need.</td>
<td>Student: Identifies information resources in which to search, but none are subject-relevant.</td>
<td>Student: Does not identify information resources to search.</td>
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<td><strong>Manage</strong></td>
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Shifting the Educational Paradigm

20th Century Safety Education Paradigm: Teaching "safety" as a collateral lab skill

21st Century Safety Education Paradigm: Teaching lab safety literacy as a fundamental aspect of doing science

Kuhn's Cycle of Paradigm Shift
Safety Culture in Action: Sharing Lessons Learned

The Importance of Situational Awareness & Face Protection
Cultural Lessons I Learned from this Video

1. The UCLA fire had cultural ripple effects as well as technical ones
2. What “Upper Management Support” Means in Academia
3. Look for Buried Lessons in a Story
4. Ergonomics is why PPE is the first place to blame in lab events
Questions?

"Thanks to yoga, I now gently stretch to conclusions instead of jumping to them."

Path of least resistance. Of course it's slippery.