Advancing Scientific Literacy with Inquiry Lesson Plans Using ChemMatters Magazine

Kathy Chesmel, Ph.D.
New Egypt High School, New Egypt NJ
Publisher: American Chemical Society
Readership: High school students

*ChemMatters* articles help students:

- Connect new ideas and information to existing knowledge
- Learn about science topics in the context of everyday-life experiences
- Increase the volume of scientific reading and build up stamina for reading scientific texts
- Use evidence to inform arguments.
- Reinforce and develop scientific vocabulary.
ChemMatters Teacher’s Guide

- Available online for free
- One Teacher’s Guide for every ChemMatters article
- Provide teachers with extensive information and tools for building lesson plans and broadening knowledge about chemistry.
- Include sample questions, reading strategies, background information on article topics, connections to chemistry concepts, and connections to NGSS and CCSS.
How to receive *ChemMatters*

- **Individual subscription**: $16 per year (four issues)
- **Individual subscription to a set of \( n \) copies**:
  - If \( n<4 \): $16 \times n \) (eg: if ordering 3 copies, subscription cost = $48)
  - If \( n=5 \) or more: $8 \times n \) (eg: if ordering 10 copies, subscription cost = $80)
- **Membership benefit of the American Association of Chemistry Teachers (AACT)** (only one copy per issue, no sets). Membership fee = $50.
The Best of ChemMatters: Connecting Science and Literacy

• Extensive collection of 12 lesson plans based on highly ranked ChemMatters articles (by teachers and students)
• Produced by a reading specialist, a high school teacher, and five high school teachers who field-tested three lesson plans.
• Selected ChemMatters articles:
  ➢ received high ratings from students and teachers
  ➢ cover a wide range of topics
  ➢ address the majority of the CCS-ELA reading and writing standards for literacy in history/social studies, science, and technical subjects.
• Will be available for purchase on Sept. 30 (at: www.acs.org/chemmatters).
Objectives:

1. **Discuss** what literacy means for science classrooms.

1. **Identify** how chemistry teachers can help students improve their literacy skills.

1. **Discover** the utility of ChemMatters Magazine as a source of rich and interesting scientific content.

1. **Create** strategies to utilize a specific ChemMatters article in your classroom (group think / share).

1. **Explore** the “Best of ChemMatters” as a resource.
Some definitions

**SCIENTIFIC LITERACY**: Understanding of scientific concepts required for good citizenship.

**CONTENT-AREA LITERACY**: Language skills required to understand content knowledge.

**STUDENT INQUIRY**: Students develop an understanding of how science works. Requires the ability to pose questions, create explanations and ultimately share discoveries.
Shared concerns

- Many state science standards emphasize how we know, as well as what we know.
- Most textbooks ignore how we know, focusing instead on what we know.

Where do we find resources?

The Knowing - Doing Gap

“Knowing is not enough. We must apply. Willing is not enough. We must do.”

Von Goethe
How can teachers integrate science and literacy?

Teachers need vetted, high-quality reading materials written by scientifically literate authors.

Reading materials should:

- Be evidence-based.
- Be of high interest to high school students from diverse backgrounds.
- Contain rigorous and challenging text appropriate for high school students.
- Have an appropriate reading level.
Examples of high-quality science-based reading materials

**Magazines**
- Discover
- Scientific American
- Science World (Scholastic)
- Newsela (digital)
- ChemMatters (American Chemical Society)

**Newspapers**
- The New York Times’ Science section
- The Washington Post’s Health & Science Section
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How to improve “literacy”

**Reading Guides/Questions are NOT ENOUGH!**

**Read:** Different texts; With a purpose; Out loud; Practice close reading techniques (digital and old school); Teach various note taking techniques; Have students revisit their notes/text **OFTEN** as their learning progresses.

**Vocabulary:** Identify and define from context; Create word webs; Require use in conversation.

**Write:** **OFTEN!** And not just for lab reports. Rough drafts edited by peers; Journals/blogs; Change audience; Use different voices.

**Create Visuals:** Video lab reports and study guides; PSAs; Commercials; Infographics; Comic Strips; Story Books.

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*American Chemical Society*
Graphical Literacy

“As a Matter of Fact” - April/May 2015
Simple Article: Multiple Uses

MORE THAN JUST SUB PLANS!

Flow Chart: Collaborative effort; Manipulatives; Explain final creation

Map Content: Combustion; Equations; Gas laws; Final Study Guide

Chemistry of Everyday Experiences:
• Introduce during winter season
• Explain to family and friends

Bob Becker, February 2005
Some of my experiences

Gender and age appropriate topics: Crosslinked color on the move, Sports Supplements: Helpful or Harmful? and Smartphones, Smart Chemistry.

Content in familiar contexts: Tanking-up: compare compression and diesel engines.

Writing / code switching: Tattoo Goes Skin Deep: write letter as a shop owner to parents of student who wants to get a tattoo. Support opinion.

Arts Integration- Logo creation
More uses for ChemMatters

Use at any place in lesson/unit: Introduce Content, Reinforce Concepts, Closure or Final Assessment

Practice Calculations: Crash of Flight 143 and A Measure of Confusion. Unit conversion and measurement systems.

Critical Reading/Exam Questions: Are Artificial Dyes Bad for You? Comprehension questions and written argument regarding safety of dyes.

PBL/Service Learning Activities: 1- PSAs Drugs Down the Drain and Is this water recycled sewage? 2- Alternative energy web page based on information from articles such as Fracking, Geothermal Energy, Nuclear Power, H2Go.
Another favorite

Possible Places to Implement:
Lab Safety / Home Safety
Experimental Design: Models, Controls, Animal Testing
Graphing and Statistics
Measurements and Unit Conversions
New Resource:
The Best of ChemMatters

LESSON PLAN
“THE MANY COLORS OF BLOOD”

Article Summary: Respiratory pigments are responsible for a variety of colors of blood in animals.
What did we learn?

**Literacy Skills:** Essential for success in science classrooms.

**Teaching Literacy:** We need to do more, but don’t need to change all that we do!

**ChemMatters:** Great resource to help kids learn chemistry content AND improve literacy.
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M1. Make sense of problems & persevere in solving them
M2. Reason abstractly & quantitatively
M3. Construct viable arguments & critique reasoning of others
M4. Model with mathematics
M5. Use appropriate tools strategically
M6. Attend to precision
M7. Look for & make use of structure
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Science

S1. Ask questions & define problems
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S8. Obtain, evaluate & communicate information

ELA

E1. Demonstrate independence in reading complex texts, and writing and speaking about them
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Graphical Literacy

ELEMENTS OF A SMARTPHONE

In a smartphone, elements are used in various parts of the device. Indium tin oxide is used in the screen, which maintains conductivity. This allows the screen to function as a touch screen. The glass used on the majority of smartphones is an aluminate glass, composed of oxides of aluminum (Al₂O₃) and silicate (SiO₂). This glass also contains potassium ions, which help to strengthen it.

A variety of Rare Earth Element compounds are used in small quantities to produce the colors in the smartphone’s screen. Some compounds are added to reduce UV light penetration into the phone.

In the battery, the majority of phones use lithium ion batteries, which consist of lithium cobalt oxide as the positive electrode and graphite (carbon) as the negative electrode. Some batteries use other metals, such as manganese, in place of cobalt. The battery's casing is made of aluminum.

Magnesium compounds are alloyed to make some phone cases, while many are made of plastics. Plastics will also include flame retardant compounds, some of which contain bromine, which can be included to reduce electromagnetic interference.

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**ELECTRONICS**

Copper is used for wiring in the phone, while copper, gold, and silver are the major metals from which microelectronic components are fashioned. Tantalum is the major component of micro-capacitors.

Nedel is used in the microphone as well as for other electrical connections. Alloys including the elements praseodymium, gadolinium, and neodymium are used in the magnets in the speaker and microphone. Neodymium, lithium and dysprosium are used in the magnetic unit.

Pure silicon is used to manufacture the chip in the phone. It is substrated to produce non-conducting regions, then other elements are added in order to allow the chip to conduct electricity.

Tin & lead are used to solder electronics in the phone. More solder-free solders use a mix of tin, copper and silver.

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