Workshop 2
Macro to Micro Structures

Teaching for Conceptual Change: This program deals with the conceptualization of micro processes and environments. It involves teaching chemistry through macro phenomena, which can be observed, and micro processes, which occur on the molecular level and can only be imagined. Conceptual change must occur in order for students to understand chemical phenomena. Teaching for conceptual change poses a great challenge to teachers because they must create imaginary and physical models in order to help students visualize microenvironments and processes that occur within them.

Learning Objectives

• To create the connection between macro phenomena and micro processes
• To find ways to deepen understanding and trigger conceptual change

Pre-Workshop Preparation

1. Read the following: “A Conceptual Change Model,” by Dorothy Gabel, in ChemSource, version 2.1 (Orna, Mary Virginia, O.S.U.; Schreck, James O. & Heikkinen, Henry, eds.), vol. 1, PEDA, pp: 8–9, 1998 (in the Appendix of this guide). What are the main steps which lead to conceptual change in teaching chemistry? Discuss the example given and bring examples from your own classroom.

2. Plan a classroom activity/discussion that addresses conceptual change by choosing one or more concepts and planning how to teach them.

3. Go to http://books.nap.edu/html/nses/html/3.html. Print out these pages and bring them to the workshop session. Write down the five basic assumptions for the creation of Science Teaching Standards and explain how they are reflected in the Standards. Give examples of how you address the Standards in your own classroom teaching, and how they lead to teaching for conceptual change.
Getting Ready (30 minutes)

Discuss, first in pairs, then as a class, the Science Teaching Standards: What are the most important issues? How do you address them in your own teaching? Use them to create a list of criteria to assess the performance of science teachers. Use the list to reflect on your own teaching and to evaluate the teachers in this and following programs.

Watch the Workshop Video (60 minutes video/60 minutes discussion)

Focus

This workshop is about the relationship between macro phenomena and micro processes, and about processes of conceptual change that students undergo in understanding the molecular world.

Unit 2.2. Observing Change

Stop the video following the slide about observing.

“It’s all in how we see it”—Discuss the importance of observing phenomena to the induction of concept learning in chemistry. Do students see or observe? How can you guide students in making valuable observations about new phenomena?

Unit 2.3. Quantifying

Stop the video following the teachers’ forum.

An important issue about teaching chemistry is that students have to do calculations about things that they can’t see. Suggest ways to simplify this to them. How would you use Mr. Williams’s activity to relate between the concept of molecular concentration and the calculations of the chemistry involved?

Unit 2.4. Using Models

Stop the video following Dr. Geller’s interviews.

What new concepts does Dr. Pierce address in her lesson, and how does she teach them? How does she use models in order to overcome the difficulties in explaining the relation between macro and micro to the students? Do you face the same issues in your class?

Unit 2.6. Experience and Evidence

Stop the video following the slide about fireworks.

Notice Mr. DeGennaro’s comments and answers to the students. How does he use affective aspects in order to gain attention and induce learning? What methods and technology does he use to help his students become involved in active learning? How do his students react?

Unit 2.7. Using Imagination

Point out different levels of concept understanding between different groups of students. What are difficulties in alternative assessment of students in such activities? Can art be part of chemistry teaching? (See also Unit 2.5 about the chemistry of art.)
**Workshop Session (On-Site), cont’d.**

**Going Further (30 minutes)**

Discuss your comments about teaching in each segment. Explain in which classroom segments you see teaching for conceptual change. Present and discuss your homework assignments in light of what you have seen and discussed in the programs: which concepts are difficult, how it is possible to teach them or correct misconceptions about them, and what further ideas you can suggest for teaching for conceptual change.
Between Sessions (On Your Own)

Homework Assignments

1. Summarize your own comments about what you’ve seen and learned from the observation of teaching in the video. Write down the main principles of teaching for conceptual change, as you see it. Give examples from the program.

2. Relating macro and micro—go to Workshop 2: Activities and Quotes in the Appendix and search for examples and teaching tips that relate to this subject. Choose one example and explain how you would implement it in your classroom.

3. Read Ms. Olin’s quotes in the Appendix about using chemistry in art preservation. At what point in the curriculum could you use her examples? How would you benefit from it as related to conceptual change?

4. Go to http://www.chm.davidson.edu/chemistryapplets/spectrophotometry/beerslaw.html about Beer's law which relates concentration and absorbance. Follow the instructions, plot and print several graphs of absorbance vs. concentration. Explain the dependencies that you observe.

For additional information and activities about instrumentation in chemistry, go to the ChemSource Web site at http://intro.chem.okstate.edu/ChemSource/chemsource.html.