Please use the following three-part protocol (adopted from Thinking Through a Lesson Protocol* by Dr. Peg Smith) to help you think through these issues. You need not answer each question, but rather use them as a guide to help you cover all the important bases. This protocol employs generic terms "activity" and "lesson" to represent different ways students might participate in your lesson. The way they participate will vary depending upon your goals and the curricular content. The generic treatment is intended to make this protocol useful for goals involving conceptual understanding as well as inquiry skills and epistemological understanding.

**Part 1: Selecting and Setting up a Science Lesson or Activity**

- What are your goals for the lesson or activity (i.e., what is it that you want students to know and understand conceptually or epistemologically about science as a result of it)?

- In what ways does the lesson or activity build on students' previous knowledge of scientific ideas or practices? What concepts, ideas, or understandings do students need to know in order to begin to work on the activity? What questions will you ask to help students access their prior knowledge?

- What are all the ways students might engage the activity successfully?
  - Which of these methods do you think your students will use?
  - What misconceptions might students have?
  - What errors might students make?

- What are your expectations for students as they work on and complete the activity?
  - What resources or tools will students have to use in their work?
  - How will the students work -- independently, in small groups, or in pairs -- to explore the activity?
  - How long will they work individually or in small groups/pairs? Will students be partnered in a specific way? If so in what way?
  - How will students record and report their work?

- How will you introduce students to the activity so its requirements are clear? How will you introduce the activity so the students are likely to engage important scientific ideas or practices? What will you hear that lets you know students understand?

**Part 2: Supporting Students' Exploration During the Activity**

- As students are working independently or in small groups:
  - What questions will you ask to focus their thinking?
  - What will you see or hear that lets you know how students are thinking about the scientific ideas?
  - What questions will you ask to assess students' understanding of key scientific ideas or problem solving strategies?
  - What questions will you ask to advance students' understanding of the scientific ideas?

- What questions will you ask to encourage students to share their thinking with others or to assess their understanding of their peer's ideas?

- How will you ensure that students remain productively engaged in the activity?
  - What will you do if a student does not know how to begin participating in the activity?
  - What will you do if a student finishes the activity almost immediately and becomes bored or disruptive?
  - What will you do if students focus on non-scientific aspects of the activity (e.g., spend most of their time making a beautiful poster of their work)?

**Part 3: Sharing and Discussing Student Solutions**

- How will you orchestrate the class discussion so that you accomplish your science learning goals? Specifically:
  - Which solution paths do you want to have shared during the class discussion? In what order will the solutions be presented? Why?
  - In what ways will the order in which solutions are presented help develop students' understanding of the scientific ideas that are the focus of your lesson?

  - What specific questions will you ask so that students will:
    - make sense of the scientific ideas that you want them to learn?
    - expand on, debate, and question the solutions being shared?
    - make connections between the different ideas that are presented?
    - make connections between the ideas presented and scientific content?

- What will you see or hear that lets you know that students in the class understand the scientific ideas that you intended for them to learn?

- What will you do tomorrow that will build on this lesson?

*The Thinking Through a Lesson Protocol was developed through the collaborative efforts (lead by Margaret Smith, Victoria Bill and Elizabeth Hughes) of the mathematics team at the Institute for Learning and faculty and students in the School of Education at the University of Pittsburgh.

Smith, M.S. & Bill, V. (2004, January). Thinking Through A Lesson: Collaborative Lesson Planning as a Means for Improving the Quality of Teaching. Presentation at the annual meeting of the Association of Mathematics Teacher Educators, San Diego, CA.

*Hughes, E.K., & Smith, M.S. (2004, April). Thinking Through a Lesson: Lesson Planning as Evidence of and a Vehicle for Teacher Learning. Poster presented as part of a symposium, "Developing a Knowledge Base for Teaching: Learning Content and Pedagogy in a Course on Patterns and Functions " at the annual meeting of the American Educational Research Association, San Diego, CA.*