# UNIVERSITY AT ALBANY
### State University of New York

# Teaching *at* ALBANY

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## Special UAlbany Event

### Inquiry-Based Learning
Two workshops
by Virginia S. Lee, Ph.D.
Editor of *Teaching and Learning Through Inquiry*

Friday, March 7, 2008
Reservations Required.  Please RSVP to teachingandlearning@albany.edu or 442-5521

### Significant Learning Through Student Inquiry
10:00 AM Campus Center Assembly Hall
How do we get students to stop waiting for knowledge and start looking for it? This interactive session will provide specific examples drawn from several disciplines, opportunities for participants to experiment with their own courses, and constructive feedback from fellow participants and the workshop facilitator.

### Lunch
11:30 – 12 Noon Campus Center Assembly Hall

### Inquiry-Based Learning for All Levels
12 Noon - 1:30 PM Campus Center Assembly Hall
In this workshop participants will consider the function of uncertainty in inquiry-based learning, then examine how we can help promote actively students' tolerance for uncertainty at various stages of their development.

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# Do Students Learn When We're Not Teaching?
## *The case for instructional inversion*

"The more time I invest in my teaching, the more effective it will be, and the more students will learn," goes the logic of good intentions. Wanting to do our job well, we are tempted to distill and pre-package our course content for students, much in the way textbook publishers do. We take pride in the "perfect" lecture with its careful organization, entertaining examples, and rich visual support.

The unintended consequence of high production values, however, can be diminishing returns in student learning.  A brilliant lecture that presents a body of information as "finished" often reduces the student's responsibility and role to that of passive, bored bystander. (If we've done all the work, what is left for them to do?)  Students learn best when they are required to build their understanding from non-sculpted blocks of information.  Information intentionally presented to be incomplete and "problematic" has the same captivating effect on students as confronting a puzzle.  A puzzle invites participants to confront uncertainty, sort through distractions, and make some sense of a fuzzy situation.  Contrary to the logic of good intentions, effective instruction "problematizes" key content by "staging" it as conceptual puzzles that induce curiosity and invite inquiry leading to mastery of a way of thinking.

### "Problematizing" content for inquiry and discovery
Staging content for inquiry requires a different kind of instructional preparation than does a lecture, but with practice it does not require more time.  And the payoff  in student learning and motivation can be enormous.

Students experience most university learning as a deductive process in which generalizations (principles, concepts, rules) are presented first, followed by specific examples/data intended to illustrate those generalizations.  If we eavesdrop on the classes we pass by in the hallway, we are likely to witness this familiar pattern:
    1. Here is an important concept: X
    2. Next, here are some examples of X
    3. Let's now use X to explain the following situation or phenomenon

Step 3 is the typical locus of activities where students might observe a case or study a problem to test their own understanding.  This "Now you try it" phase commonly occurs at the end of lectures and textbook chapters.  While this conventional sequence looks completely benign, what it asks students to do is intellectually unambitious.  Even if the case involves a truly complex phenomenon, the student is merely asked to identify or apply a specific known structure.  A case/problem used in this way might look like an inquiry, but in reality it asks students to replicate procedural thinking that someone else has already done.

### Deductive vs. Inductive?  Depends…
For advanced students who are already adept at analyzing information for its validity and accuracy, the top-down nature of the deductive approach presents no problem.  Deductive processing of information is an efficient way to receive new disciplinary tools for mature thinkers who are already able to filter and absorb new information into a complex, critical view of the discipline as an ongoing process of making knowledge.  Ph.D. students, for example, should be expected to spot the gaps and ambiguities they encounter in books or lectures.

For less advanced students, however, the top-down approach interferes with developing a questioning attitude.  Beginners are more likely to accept without question and memorize what we tell them about X and

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its examples as a unit of authoritative, complete information. For students still learning what it means to ask questions and "think like a chemist" or "think like a sociologist," the world of information is undifferentiated. Abstractions in the form of concepts, theories, and arguments can appear on a par with facts, data, and other evidence that merely support them. This is one reason why beginning students will sometimes ignore the main objective of an exam question, and proceed to regurgitate anything they can remember about the topic. From the beginner's point of view, information is information, and it's all good if it comes from the professor or from the textbook. Deductive teaching reinforces this non-critical disposition.

### The Inverse Model

We can move students quickly away from their naïve view by designing less directed encounters with course content. Content can be "un-packaged" and "re-problematized" for puzzle-making by removing its explanatory context, and by removing the appearance of its being "finished" knowledge. As an example, let's take from the literature on university teaching William Perry's "Scheme of Ethical and Intellectual Development." Perry describes the intellectual stages through which individuals pass over time, from the early stages of black & white thinking or "dualism" ("please tell me the right answer"), through mindless tolerance or "multiplism" ("one opinion is as good as another"), through reflective tolerance or "relativism" ("I find it useful to see all sides of a situation"), to conscious choice amid uncertainty, or "commitment" ("in light of what we know, this is our best choice"). If we were to teach Perry's Scheme in the traditional manner we would

1) Define (X) the stages of intellectual development that Perry identifies, then
2) Offer examples of (X) Perry's stages as might be observed in human behavior. Learners might then be asked to
3) Apply (X) Perry's scheme to specific cases or situations.

Because the movement in this case between definition of the concept and its application is linear and reductive, students may be inclined to memorize the stages and apply the theory mechanically ("if she says x, then she is a dualist"). This linear process has by-passed the messiness of applying Perry's Scheme in reality. Explaining the Scheme in this way risks superficial understanding.

An inductive approach would require students to construct Perry's Scheme for themselves. An activity might look something like this:

1) Students examine a selection of statements reflecting varying levels of intellectual development (with no reference to Perry). Students are asked to analyze the statements according to levels of naïveté of thinking and rank them.
2) From this naïve perspective students are then asked to justify their rankings so as to uncover their working assumptions.
3) In debriefing this process, the instructor asks students to examine reasons for any disagreements among students' different ranking schemes, and to begin refining the rankings based on comparison and reflection.
4) Finally, the instructor shows students where they stand in comparison to "other" theorists who attempted to make distinctions of this type. Perry's Scheme is offered as one of the more durable of these explanations, and a current point of reference, however limited or flawed.

Students who "learn backward" rather than simply memorize and apply Perry's Scheme are more likely to remember the targeted concept and to develop a better understanding of the ideas behind it. These improved outcomes result from students' having struggled to (re-) build concepts from discrete pieces of information. Through the inductive process students are more likely to gain insight into the knowledge-making that characterizes the research and scholarship of every discipline.

Most importantly, students who learn this way develop the habit of inquiry and the confidence that their observations matter, even in areas where their knowledge is limited. This approach to teaching and learning can work in any discipline, including highly technical ones, and there is a growing body of research (see below) showing how instructional inversion promotes critical thinking. Putting students into the role of inquirers, questioners, and discoverers—at every level—is essential if we want to accelerate their ability to function in the "information culture."

Blau, S. The Literature Workshop: Teaching texts and their readers. Boynton/Cook, 2003.

Hake, R.R. "Socratic Pedagogy in the Introductory Physics Lab," Phys. Teach. 30, 546 (1992).

Perry, William G. Forms of Ethical and Intellectual Development in the College Years: A Scheme. Jossey-Bass, 1998.

Prince, M. and R. Felder. "The Many Faces of Inductive Teaching and Learning" in the Journal of College Science Teaching. April 2006. (April 2006, vol. 95, no. 2)

Reimers, C. and W. Roberson, "Re-problematizing the disciplines; or, how we can transcend academe's false priorities." Workshop at 2007 POD Conference. Pittsburgh.