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## **Introduction**

I see my participation in the Faculty Learning Community (FLC) as part of a greater teaching/research synergism in my career. In recent years much of my teaching energy has been focused on how to improve student learning in my classroom, and how to assess whether the changes I make are effective. I've been aware, for instance, of the recent emphasis on techniques such as active learning, Bloom's taxonomy or concept mapping, but have been struggling with how to incorporate them into my own classes. The idea of using a scientific approach to teaching, the same approaches I use in my discipline research, was incredibly appealing, and I have found it very rewarding.

I was fortunate to be selected as a participant in a pedagogical project within my discipline during 2005-2007. Teaching Issues and Experiments in Ecology (TIEE) is both a peer-reviewed journal as well as a group of faculty who have been involved in improving the teaching of ecology and raising the profile of pedagogical scholarship (see <http://tiee.ecoed.net/misc/about.html>). As part of my participation in TIEE, I was briefly trained in a workshop to: 1) develop a pedagogically-based project and 2) learn assessment techniques for how to evaluate changes I made in the classroom. This experience culminated in a published article (Hane 2007), and an invited symposium talk at the Ecological Society of America (August 2008).

TIEE was much like FLC in many ways, although I think that the bi-weekly meetings of FLC made it much more rewarding on a personal level. The chance to take two hours and set them aside to think and talk about pedagogy is incredibly valuable. TIEE was an add-on because the work had to be done in addition to my regular teaching and research load, but FLC felt much more integrated into my faculty life. I gained much from both experiences.

I have also been lucky to be supported by my department in these endeavors. Both my past (Tom Frederick) and present (Dick Doolittle) department chairs were FLC members, and both were supportive of my application to TIEE and to FLC7. It was with great anticipation that I joined FLC7 in the fall of 2007, and I have been thrilled with the experience.

## **Philosophy of Teaching**

My own teaching philosophy for ecology has arisen largely as a reaction from my own education as a scientist. I was frustrated by biology in high school and early in college because biology to me meant sitting in a dark room looking at slides of cells and reading about organisms in textbooks. I felt no connection between what I was reading and the world around me. The proverbial light came on during a field trip for an ecology course, late in my

junior year. As we walked through the forest, the remote and inaccessible equations and theories about populations and communities suddenly started to have grounding in what I saw around me. A million questions started bubbling up inside me. Why were there so many species of trees on the Texas Gulf plain and so few in the forests I had experienced in Washington? What is the advantage of being deciduous vs. coniferous? Why did some species have saplings in the understory, and others not? And why had it taken me several years of dry, disconnected biology courses to finally find something that felt real?

Understanding community compositions and distributions of plant species in both time and space has become my research passion, but alongside that, I have also been striving to find a way to help my students make those same connections that I have, and find real world meaning in the theories that make up ecology and environmental science. Part of that can be achieved simply by exposing students to the landscape and challenging their ideas about the world around them. But additionally, I think it is increasingly important to expose students to ideas and questions that have implications for policy and social relevance. What happens to a forest after it is clearcut in various parts of the world? How does this inform us about what our policies should be? Exciting their imaginations is not enough by itself; students in ecology and environmental science must be challenged to make their ideas and discoveries relevant to society as a whole.

While it is often not possible to tailor a course for each individual learning style, it is possible to help the students understand what methods work best for them in learning the material and keeping them intellectually engaged in the subject. By providing the material in a variety of formats, the students are able to access the material in a way that is most meaningful to them. As someone who is mildly dyslexic, I found learning botanical taxonomy out of a textbook to be incredibly frustrating, and I frequently fell behind in lectures looking at slides. But when I was exposed to the plants in the field and could place them in context, I found the learning not only more enjoyable, but more efficient. I learned how to identify plants, a skill, rather than memorizing information, which were merely facts. Thus I try to combine lectures with small group discussion, presentation by students, and direct observation in the lab or field as often as I can. Using multiple teaching methods helps students who have different learning styles, and also gives them valuable experience in effectively communicating what they know.

I also strive to engage my students in real, inquiry-driven research projects as early as possible. I see teaching ecology not as merely giving the students knowledge about a subject, but also as an opportunity to train them as scientists. Thus I emphasize the importance of reading critically, identifying and developing strategies for solving problems, writing clearly and communicating effectively orally. One of the best ways to teach students about science is to involve them in my own research projects, and help them develop their own questions and projects. I have been fortunate enough to see students that I mentored go on to graduate school or successful jobs at environmental agencies, but I have also had the satisfaction of seeing some go on to non-scientific jobs where they use their scientific skills effectively in other areas. Critical thinking, strong writing, communications and interpersonal skills are critical no matter what a student does when they graduate. I see my role as facilitating the acquisition of those skills for all my students.

## **Metaphor for Teaching**

My metaphor for teaching comes from my training as a plant ecologist, and incorporates the idea of gardening. A good gardener knows that not all plants thrive in all environments. For example, you wouldn't grow an azalea in a limestone-rich soil, because plants in the rhododendron family need acidic soil to thrive. If you want the plant to be successful, you will need to change the environment to match the plants needs. To be good at this requires knowledge of the individual plant's needs and also the ability to change the environment.

Similarly, teaching requires knowledge of individual student's needs, and often requires the need to change the teaching environment. Tools, such as emphasis on metacognition, active learning, scaffolding or other techniques may help individual students thrive and succeed, but you have to be able to identify the students' needs to do this effectively.

## **Description of FLC project**

Title: A Metacognitive Tool to Improve Student Writing Skills

My project was based on an idea I saw presented at the Lilly Conference on College Teaching (Jenn Anderson's presentation on Integrated Reflective Writing). Although she did not present it as a metacognitive tool, I think in essence that's what the tool was being used for – to “prompt students to critically engage” the writing process. Metacognition is thinking about learning (National Research Council 2000). I think students need to remember more often that they are responsible for their own learning, and that they need to be mindful of what works best for them as individuals and monitor their learning. There are prompts and tools I can use to help them, and this project was designed to determine if the “comment” tool would improve their writing.

I incorporate writing into many of my courses, and I am often appalled at the state of writing in the first draft that students turn in. How do I get students to think about what they are writing and improve their own writing before the first draft? Students often get “stuck” at various writing stages and don't know how to solve their problems or worse, don't realize that they're having problems. I decided to try to use a tool that would help students think about their writing as they were writing.

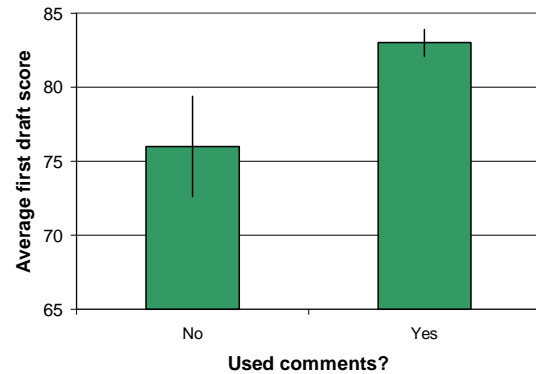
My project focused on my Biological Writing course (1001-320), which is a majors' course for students in Biological Sciences. In this course, I used many different writing assignments, though for this project, I chose to focus on the one that gives students the most trouble: the scientific journal article. In this assignment, students write about their own research experiences, and produce a journal-style paper. They write a total of three drafts.

My hypothesis was that by making students aware of what they are writing and how they are writing, they may become better writers. To do this, I asked students to use the

“comment” function, endnotes, footnotes, or even parenthetical comments to make comments or ask questions of their peers or the instructor. Students were told that use of the tool was optional, but were encouraged to try it. Out of 25 students in the class, 17 of them used the tool at some point.

In order to assess use of the tool, I compared grades on the first drafts of students who used the tool versus students who didn’t use it. This method of assessment may be confounded, however, since weaker students may have elected not to use the tool, and stronger students may have been more motivated. I also passed out a brief questionnaire to ask students about their use of the tool.

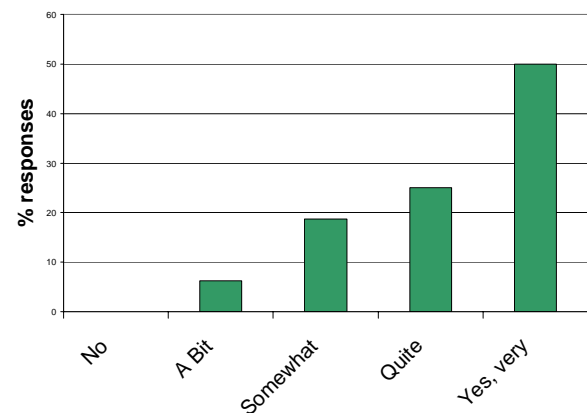
Students who used the tool did significantly better on the first draft compared to students who did not use the tool, as measured by a t-test ( $p = 0.02$ ; Figure 1).



**Figure 1.** Students ( $n = 14$ ) who used the comment function did significantly better on the first draft compared to students who did not use it. Error bars indicate standard error.

Most students who did not use the tool reported that they didn’t use it because they forgot it was available as an option. This suggests that perhaps in the future I should remind them about the use more often.

Using a Likert-scale question, I asked students, “Was using the tool helpful to you in the writing process?” Three-quarters of the students reported that the tool was “quite” or “very” useful. No students found the tool completely useless (Figure 2).



**Figure 2:** Student responses ( $n=17$ ) to the question, “Was using the tool helpful to you in the writing process?”

Most students indicated that they found the tool most useful for asking specific questions about their writing and the mechanics and rules of the paper. This matches my observations of what the students did in their actual writing.

Excerpts from student responses to the open-ended question can be seen below:

*Did having the option to ask questions/make comments help you with the writing process? If so, how?*

- *Yes, it helped me address more specific concerns that I had that I would have otherwise ignored. It also helped me stay organized and forced me to proofread a little more than I usually would have.*
- *Yes, it helped me think about what I was having problems with instead of ignoring them.*
- *Yes, I didn't have to second guess myself because I could just ask a question, so it made writing faster and easier.*
- *Somewhat, because it allowed me to receive specific feedback about questions I really needed answered.*
- *I think so, because it made me more aware of what I was writing and what relevant information to insert or leave out.*

My sense is that the project was successful. Giving students the option to make comments/ask questions in the draft stage helped some of them think more about the writing process. The comment process may also have contributed to a supportive writing environment where students could get specific feedback on problems with their writing, turning the correction process into more of a dialogue. Future questions should focus on whether to make the comments mandatory for all students, and then how to assess their use.

### **Reflections on FLC Experience**

I would like to thank Susan Donovan, Trudy Howles and Sarah Cass for their attention and dedication this year. This opportunity has allowed me to develop as a teacher and more importantly, as a learner. I've also had the great fortune to meet many other people who are passionate about teaching and who have grown to genuinely care about each other in this supportive environment.

#### *The Perry Scheme*

One of the first eye-opening experiences I had in this group was reading the paper about the Perry Scheme of Intellectual and Ethical Development, which describes the journey that individuals take from dualistic thinking to a commitment to constructed knowledge. When I read the article for the first time, I reacted somewhat negatively to it, and thought it was too simplistic to be useful. But in the discussion we had in the group setting, it became obvious that it resonated with many of the group members, including one member who felt strongly that there were benefits to dualistic thinking.

The discussion caused me to reflect on my own journey as a learner, and in particular about a pivotal course I took as an undergraduate at Rice University. I was a double major in English and biology, and although I am now a scientist, the English courses I took were instrumental in my intellectual development. During my sophomore year, I took a seminar course that focused on a single Shakespeare play, *Anthony and Cleopatra*. We spent whole class periods pouring over individual words and lines and what the implications were for the different interpretations of the language. At first, the class

frustrated me – I just wanted to know what the answer was. What did Shakespeare mean when he wrote these lines, and what did it mean for the motivations of the characters and the outcome of the play? But the instructor was patient, and I gradually came to realize that there were multiple interpretations of the language of the play, and that perhaps it was intended this way. I then went through a phase of multiplicity where I thought there was no right or wrong interpretation, and that it was all deliberately ambiguous. This frustrated me as well. Gradually, then, I came to realize that if you read the context carefully, then you can puzzle out a few specific readings, and my knowledge of the broader context allowed me to evaluate the different meanings and decide which ones were better than others. This course was the most important of my undergraduate education, and not only taught me to read and write critically, but also helped develop my intellectual capabilities beyond a dualistic worldview.

I haven't figured out exactly how to use the Perry Scheme to improve my teaching, but the knowledge that my students may be at different stages is important to keep in mind and has helped me understand them a little better. Just being reminded that I was once in their frame of reference was important.

### *How People Learn*

I've read the full version of this book in a previous reading group, and find it endlessly fascinating. It was my first introduction to metacognition, which is slowly but surely changing how I approach teaching. Every faculty member should read this book.

### *The Lilly Conference on College Teaching*

As an introvert, I find conferences overwhelming, and Lilly was exceptionally so. There were so many bright minds and enthusiastic ideas about teaching that it was hard to know what to carry away from the conference to use in my classroom. I spent a lot of time outside of sessions wandering around the beautiful campus and thinking about what I'd learned.

Here are a few highlights for me:

- Jenn Anderson's presentation on Integrated Reflective Writing – I ended up using this for my FLC project (see above). It was developed by a graduate student in communications, and I found it incredibly useful. A simple, elegant application of available technology that made a real difference!
- WebGURU – a website for supporting undergraduate science research. I use this as a resource for my research students as well as the students in my writing class. It's also been posted to the College of Science resources page.
- Miami University President David Hodge's keynote address – I was so moved by this address that I sent the link of the recording to my chair and my dean. The idea of developing the student as a scholar and learner is so important, and I think

having students participate in undergraduate research is a key component of their education as scholars. My own research in pedagogy has focused on ways to move the research experience into the classroom so more students can participate.

- Barbara Millis' workshop – I realized I'd attended this workshop when it was offered at RIT, but it was good to be reminded of some strategies of putting active learning into the classroom.
- Dee Fink's strategies for course construction really challenged me to think about what I want my students to get out of my courses. I've always been skills-based, but how do I assess the acquisition of those skills? A much harder question.
- Darby Lewes and her dog, Gwynedd – I actually beat the border collie in a "find the bone" contest! This was a great session about rewards and how they can be used effectively in a classroom environment. Fun and memorable!

I think one of the other things that came out of the conference was a greater sense of appreciation for the other FLC members and their interests and talents. It was fun to get together and debrief at lunch and dinner each evening to compare what we'd learned and seen that day.

### *Perspectives on Learning*

I actually didn't get a lot out of reading this book, but I learned a tremendous amount from other group members' presentations. This section of FLC often got a little short-changed on time, and forced the presenter to really distill the chapter and perspective down to its essence, which was actually really great. It was fascinating to see how each member connected with the material on a personal level – particularly one member with an autistic child who had used cognitive science to help him, and another member who used her knowledge of alternative instruction for children in another country to really enrich the presentation. I had the benefit of going last, so did my best to draw together all the pieces. My handout on cognitive structures is included in the appendix to this report.

### *StrenghtsQuest*

The discussion we had in the meeting before this presentation was important to me for a number of reasons. With all the emphasis on active learning, I often feel that sometimes we are leaving out those students who may be "reflective" learners. As an instructor for FYE, I took a learning inventory skills test, and came out way on the "reflective" end of the spectrum. I've always hated volunteering and talking in class as a student, and I think many of the active learning techniques would have overwhelmed me because the instructor often doesn't leave time for reflection. I need time to think and digest, and I think this is why I hate conference calls so much. I have brilliant insights several hours later.

So when my StrengthsQuest second strength came up as “intellection,” it really resonated with me:

The theme of Intellection does not dictate what you are thinking about; it simply describes that you like to think. You are the kind of person who enjoys your time alone because it is your time for musing and reflection. You are introspective. In a sense you are your own best companion, as you pose yourself questions and try out answers on yourself to see how they sound. This introspection may lead you to a slight sense of discontent as you compare what you are actually doing with all the thoughts and ideas that your mind conceives. Or this introspection may tend toward more pragmatic matters such as the events of the day or a conversation that you plan to have later. Wherever it leads you, this mental hum is one of the constants of your life.

How wonderful to be valued for this. It was so much fun to listen to what the group’s strengths were, and to realize why we function the way we do as a group is based primarily on what drives us as individuals. An important lesson for the classroom as well, I think.

*FITL*

I very much enjoyed having this “capstone” experience at the end. Sitting and looking at the group of us at the front table, the “experts” as it were, was just fun and very affirming. I met many people who approached me to discuss my poster and my presentation, and I hope that this is more of a beginning than an end.

*What have you valued most from your participation in the Faculty Learning Community?*

I think the validation of teaching as scholarship has been richly rewarding. This aspect of being a faculty member is so often overlooked. I’ve really benefited from being able to focus some of my time this year to finding ways to improve my teaching AND assess how those changes impact my students. Susan and Trudy are amazing and I am so thankful for their support and dedication.

*Describe how your teaching and your perception of yourself as a teacher have changed (if they have) as a result of your involvement in the Faculty Learning Community.*

I think my focus on metacognition has really reminded me how important it is to share my own learning experiences with my students, and to help them think about not just content. Many of the students in my classes will likely never use the actual content, but if I can teach them **SKILLS** they can use (problem solving, critical thinking, writing, and metacognitive tools) then they will become better scientists and learners as a result. That’s probably more valuable than being able to explain the difference between various photosynthetic pathways. So I see myself more now as someone who teaches skills, and uses the content as a vehicle for doing that. I’m still learning how to do this effectively, so being reminded that these tools are also useful to ME is also a valuable lesson.



**References:**

Anderson, Jenn. 2007. Integrated Reflective Writing. Presentation at Lilly Conference on College Teaching.

<http://celt.muohio.edu/lillycon/presenters.php?session=1150&year=2008>

Hane, E.N. June 2007, posting date. Use of an Inquiry-based Approach to Teaching Experimental Design Concepts in a General Ecology Course. *Teaching Issues and Experiments in Ecology*, Vol. 5: Research #3 [online].

<http://tiee.ecoed.net/vol/v5/research/hane/abstract.html>

National Research Council. 2000. *How People Learn: Brain, Mind, Experience and School*. National Academy Press, Washington D.C.

## Appendix: My Handout on Cognitive Structures

*Past is prologue:*

We've learned in the past few months that learning has two components:

- The internal events of the individual as he or she works to understand/remember
- The social environment of learning, which typically happens through communication with others



The discipline of cognitive structure strives to place both of these in a context that can be used by both teacher and learner. The focus shifts to understanding how learners store and retrieve new material from memory, and how the teacher can facilitate that process.

So what is a cognitive structure?

- A mental map of the material and how concepts relate to each other
- Internal representation of information
- A series of associations between words, concepts or other constructs

The analogy is further extended by saying that a student who has incomplete mastery of a subject has a bad or incomplete “mental map” of the material, and is therefore likely to be “lost.” They have no idea how to link the new information into the old information if the old information is incomplete or incorrect. Imagine trying to find RIT if you are wandering around on Jefferson Avenue instead of Jefferson Road, and you can imagine how a bad map can lead to a lost feeling.

Teachers can help create better mental maps by:

- Providing advanced organizers or “anchoring ideas”
- Facilitating the creation of connections or “webbing” between known ideas

So if your pre-existing mental map had included the fact that Jefferson Road is in Henrietta and Jefferson Avenue is in the city of Rochester, and you are told the “anchoring idea” that RIT is also in Henrietta, then your mental map will help orient you and keep you from getting lost by sending you to Henrietta instead of Rochester.

One of the main problems that teachers face is that students may cling to incorrect mental maps, even when faced with new, conflicting information.

Therefore a teacher needs to:

- Assess the current state of these “mental maps” before new material is presented
- Work on correcting the maps if there are misconceptions (“accommodation”)
- Tie new information into old information using “webbing”/connections (“assimilation”)

#### Techniques that can help with this:

- Pre-tests or questioning that assesses current state of knowledge
- Concept mapping (see the work of Joseph Novak)
- “Chunking” information into usable pieces that can be placed into the mental map with other related ideas (think of a filing system)
- Recognize differences between novice and expert learners (See How People Learn by the National Research Council)
- Teach students to self-monitor progress and learning (“metacognition”, also covered in How People Learn)

#### Examples:

Consider this passage:

The procedure is actually quite simple. First you arrange items into different groups. Of course, one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities that is the next step; otherwise, you are pretty much set. It is important not to overdo things. That is, it is better to do too few things at once than too many. In the short run this may not seem important but complications can easily arise. A mistake can be expensive as well. At first, the whole procedure will seem complicated. Soon, however, it will become just another facet of life. It is difficult to foresee any end to the necessity for this task in the immediate future., but then, one never can tell. After the procedure is completed one arranges the materials into different groups again. Then they can be put into their appropriate places. Eventually they will be used once more and the whole cycle will then have to be repeated. However, that is part of life. (From: <http://fcis.oise.utoronto.ca/~bdurell/3070cogs.htm>).

It would be very difficult to describe or remember unless you add the “anchoring idea” that this passage is about washing clothes.

Barbara Millis also used an example at the Lilly Conference that had a long passage of text that did not make sense without the accompanying picture. In both these cases, the learner is lost without the anchoring idea that tells them which mental map to use.