2010 Research Residency
Pre-Institute Assignments

Team 5

Facilitator: Loretta Taras

Team Members:

Kai (Billy) Hung
Stephen Nold
Joanne Rampersad-Ammons
Susan Sullivan

Kai (Billy) Hung
Eastern Illinois University, Charleston, IL

Assignment #1: Introductions

1) Describe your teaching responsibilities and the type of student you teach.

I have two main teaching responsibilities at my institution (a Primarily Undergraduate Institution with a Masters program): Cell and Molecular Biology and Microbiology.

For Cell and Molecular Biology, I teach the class that is required for all Biology (including all pre-allied health and teacher certification) majors. Class size has been about 65 in the lecture, and 24 in the lab. I teach both the lecture and the labs for this class.

For Microbiology, I teach General Microbiology, and will be teaching Environmental Microbiology. Both are high-level electives for Biology majors. The General Microbiology averages about 16 students per semester.

In addition to these classes, I am also developing new classes featuring Bioinformatics. I've taught the subject as a graduate seminar, and I will be teaching it as a special topic to undergraduates this fall. Eventually, I will create a new class to center on Bioinformatics for undergraduates.

2) Describe what you would like to take home as a result of attending the SoTL Institute.

One of the challenges I have is to find ways to fit my interest in pedagogy development into the requirement I have for scholarly activity. I would like to be able to translate the work and effort I put into improving my teaching into a scholarly process so that the work can be recognized by my peers. To that end, I would like to learn from the SoTL Institute ways to design and implement studies that can lead to publications of these results.

3) Tell us about your interests outside of the classroom and a book that you have read recently.

My interests include cooking and political news (domestic and international). I'm also learning more about amateur astronomy, or star-gazing.

One of the books I read recently is "50 Philosophical Ideas You Really Should Know." It is a breezy, approachable introduction to major philosophical ideas.

Assignment #2: Reflections

1) How would you describe your "research problem(s)" to the Research Scholars group?

Obviously, the descriptor "problem" takes on a new meaning after the reading. I find themessage in Bass' article of seeing "problems" not as difficulties to be solved, but as research topics to be explored. In this light, I will describe my "research problem" as one of wanting to find the appropriate assessment to measure student learning motivation. By this, I mean that I want to explore ways of assessing how emotionally engaged students are in their own learning, and whether their engagement correlates with the success of their learning. The ultimate goal is to be able to tailor pedagogy to address student motivation, which I believe will lead to better learning outcomes.

2) What theme(s) based on your readings, resonate with your "problem" and/or your proposed approach to address your problem.

A common theme I see in all 3 articles is the formulation of a research question out of a desire to improve pedagogy. I think my previous exposure to the topic of scholarship in teaching and learning, as well as the integration of teaching, learning, and research, have already put me on the path to re-think teaching challenges as research topics. However, Bass' article crystallized the thinking process and added clarity to my thinking. What he wrote added to my developing vocabulary to conceptualize the scholarship of teaching and learning.

3) Based on Pat Hutchings article, what taxonomy would you use to describe your research question and why?

From Hutchings taxonomy of inquiry, I find the question that I have in mind matches the first 3 categories. As Hutchings pointed out in the article, a research topic often touches on more than 1 type of inquiry. I am initially motivated by "what works," in that I want to explore whether my teaching is successful in motivating students to learn. Then came the realization that I need to figure out "what is," first, in order to be able to compare. Finally, I have ideas that I want to test, which fir the description of "visions of what is possible."

4) Do you have any questions/concerns/comments that have evolved from your reading?

I struggled a bit with the last article, which described the Classroom Action Research. On one hand, I see the restrictions of conducting research in pedagogy that CAR tries to address, given that most of us do not have the opportunity to set up controls as we would in our bench work. I cannot ask the department to start another section of a class so that I can have a control group (and what's the ethics involved even if I could?), no more than I can teach the same set of students twice in two different ways. So CAR allows us to still engage in scholarly work under these restrictions.

On the other hand, as a scientist, we accept that research data should be empirical, that science derives its merit in part because the same experiment should yield the same data under the same conditions. We do this in our research as we build on previous work to explore further questions. Since classrooms are idiosyncratic, and student demographics are not replicable, how does CAR results fit into the empirical requirement of research? Is it empirical? If not, is it still valid scholarship?

Assignment #4: Annotated Bibliography

I. Introduction

My research topic is the assessment of student motivation. I wish to investigate the effects of different pedagogical techniques in terms of enhancing student motivation for learning. For this bibliography, I intend to find articles that discuss the relation between student motivation and learning, in the context of scientific disciplines if possible. I also want to find articles with examples of assessing student motivation in learning.

II. Articles

1. *Assessing the Factors Deemed to Support Individual Student Intrinsic Motivation in Technology Supported Online and Face-to-Face Discussions.* Schroff & Vogel (2009). Journal of Information Technology Education Vol 8: 59-86.

Summary: Research has established that intrinsic motivation has a positive effect on learning and academic achievement. In order to investigate the phenomenon of intrinsic motivation in technology supported learning environments, this paper investigates the factors deemed to support individual student intrinsic motivation in online discussions. A research model is presented based on research into motivation, and the specific areas of self-determination and curiosity provide a framework for the model.

Notes: This article is a useful starting point because it referenced several other articles on the relation between motivation and learning. It is also introduced me to the idea of "intrinsic" versus "extrinsic" motivating factors. The report provides the questionnaire that the authors had developed for their study, so that will provide a good starting point. However, I am not sure if adapting the entirety of the questionnaire is appropriate for what I would like to achieve. I would like a more light-weight questionnaire so that the assessment process does not feel like a burden to the students. One other encouraging aspect of the article is that the study contains a sample size of 77, making it a target that I can achieve at my institution.

2. *Motivation in action: Towards a process-oriented conceptualisation of student motivation.* Zoltan Doernyei (2000). British Journal of Educational Psychology, Vol 70: 519-538.

Summary: It is argued that the `time' dimension is relevant to the study of motivation in at least two crucial areas: to account for (a) how motivation is generated and (b) how it fluctuates and further develops over time. A focus on the temporal dimension is particularly important for the understanding of student motivation because in prolonged learning activities such as mastering a school subject a major motivational function is to maintain the motivational impetus for a considerable period (often several years) against a number of distracting influences. In order to illustrate the temporal conception of motivation, a `Process Model of Student Motivation' is presented and various theoretical pros and cons are discussed. Finally, practical implications

are demonstrated by providing a taxonomy of motivational strategies rooted in the process-oriented approach, with one specific aspect, the students' action control and self-motivation, specially highlighted in order to show the compatibility of the approach with current research on student self-regulation.

Notes: This is one of the articles referenced in the Schroff & Vogel article. This article presents a very detailed explanation on conceptualizing motivation as a function of time in a classroom. The article was useful for understanding the theory behind motivational studies, but it does not contain a lot of immediately useable units.

3. *Science Motivation Questionnaire: Construct Validation With Nonscience Majors.* Glynn, S.M., Taasoobshirazi, G., & Brickman, P. (2009). Journal of Research in Science Teaching, Vol 46: 127-146.

Summary: This study examined how 770 nonscience majors, enrolled in a core-curriculum science course, conceptualized their motivation to learn science. The students responded to the Science Motivation Questionnaire, a 30-item Likert-type instrument designed to provide science education researchers and science instructors with information about students' motivation to learn science. The students' scores on the Science Motivation Questionnaire were reliable and related to students' high school preparation in science, GPA in college science courses, and belief in the relevance of science to their careers. An exploratory factor analysis provided evidence of construct validity, revealing that the students conceptualized their motivation to learn science in terms of five dimensions: intrinsic motivation and personal relevance, self-efficacy and assessment anxiety, self-determination, career motivation, and grade motivation. Women and men had different profiles on these dimensions, but equivalent overall motivation to learn science. Essays by all of the students explaining their motivation to learn science and interviews with a sample of the students were used to interpret Science Motivation Questionnaire scores. The findings were viewed in terms of a social-cognitive theory of learning, and directions for future research were discussed.

Notes: This article provided a 30-item questionnaire that measures student motivation in learning science. These authors broke down motivation into 5 dimensions, where each is addressed by a set of questions in the questionnaire. I am uncertain whether I can simply use this questionnaire in a content-specific class.

4. *Factors influencing academic performance of students enrolled in a lower division Cell Biology core course.* Soto, J. & Anand, S. (2009). Journal of the Scholarship of Teaching and Learning, Vol 9: 64-80.

Summary: Students' performance in two semesters of our Cell Biology course was examined for this study. Teaching strategies, behaviors, and pre-course variables were analyzed with respect to students' performance. Pre-semester and postsemester surveys were administered to ascertain students' perceptions about class difficulty, amount of study and effort put into the course, and professional goals. Chi-square ($\chi 2$) tests of independence showed that completion of chemistry requirements, passing the laboratory component of Cell Biology, homework, and attendance were related to passing our course. Logistic regression showed that perfect attendance followed by GPA, were the most important factors associated with passing the course.

Notes: This article provides an example of a publication on examining pedagogical effects on student learning in a scholarly context. It resembles what I have in mind in terms of publications

from my own future work. It offers a good template for a manuscript. The article is also about cell biology, which is the same subject area that my research will be conducted in.

5. *Clickers in the Large Classroom: Current Research and Best-Practice Tips.* Caldwell, J.E. (2007). CBE Life Sciences Educatiob Vol 6: 9-20.

Summary: Audience response systems (ARS) or clickers, as they are commonly called, offer a management tool for engaging students in the large classroom. Basic elements of the technology are discussed. These systems have been used in a variety of fields and at all levels of education. Typical goals of ARS questions are discussed, as well as methods of compensating for the reduction in lecture time that typically results from their use. Examples of ARS use occur throughout the literature and often detail positive attitudes from both students and instructors, although exceptions do exist. When used in classes, ARS clickers typically have either a benign or positive effect on student performance on exams, depending on the method and extent of their use, and create a more positive and active atmosphere in the large classroom. These systems are especially valuable as a means of introducing and monitoring peer learning methods in the large lecture classroom. So that the reader may use clickers effectively in his or her own classroom, a set of guidelines for writing good questions and a list of best-practice tips have been culled from the literature and experienced users.

Notes: This article is not related to assessing student motivation, but one of my current projects is to figure out if the data I gathered from my students on the use of clickers can be publishable. So this article provides a good introduction to the topic and offers many references to follow up on.

Stephen Nold

University of Wisconsin – Stout, Menomonie, WI

Assignment #1: Introductions

1) Describe your teaching responsibilities and the type of student you teach.

I focus on integrating authentic, relevant research into the first year student experience. My classes generate data that are later published in the peer-reviewed literature. This approach has worked in my Introductory Cell and Molecular Biology and Biotechnology courses for science majors. Ultimately, I want to use experiential research as a tool to educate non-majors environmental biology students.

My students primarily come from rural Wisconsin communities (read: Caucasian, not always prepared for college, but willing to work). One of my greatest pleasures is helping students who didn't appreciate their abilities realize they are capable of becoming scientists.

2) Describe what you would like to take home as a result of attending the SoTL Institute.

I want to come away from this residency with the tools to measure student and faculty development in a research-intensive classroom environment. I am eager to assess the impacts of research on student learning, but also to measure how faculty change their approach as they adopt classroom research.

3) Tell us about your interests outside of the classroom and a book that you have read recently

I enjoy building things out of wood and reading 18th century maritime literature.

Assignment #2: Reflections

1) How would you describe your "research problem(s)" to the Research Scholars group?

I have been doing research with students in my classroom and found this to be a powerful approach. Students who take my class participate in the thrill of scientific discovery by generating publishable research data *as part of the course*. This differs from apprenticeship-style training where faculty mentor students individually. Classroom research greatly increases the number of students exposed to original research over the apprenticeship model. I'm curious about two "research problems" that arise from using this approach:

- Do students who experience a research-intensive classroom think and work more like scientists than other students?
- Is classroom research as effective as apprenticeship-style training in developing STEM student's cognitive and personal growth?

2) What theme(s) based on your readings, resonate with your "problem" and/or your proposed approach to address your problem.

I was pleased to see that SOTL isn't all quantitative research, that there is room for diverse approaches. The idea that historians have a very different way of investigating problems is enlightening.

3) Based on Pat Hutchings article, what taxonomy would you use to describe your research question and why?

Is classroom research more effective than other approaches? I should be able to gather good data to support or refute my claims. There are also the softer aspects to explore, the "what is?" questions. As different faculty develop research experiences in their own classrooms, what do they create? Do their students have similar experiences? I am curious about exploring these questions as well.

4) Do you have any questions/concerns/comments that have evolved from your reading?

I'm afraid that I may be trying to investigate everything at once. The Bass article warned against this. I feel strongly that classroom research is a promising practice. I'm also a scientist, and am willing to change my opinions based on the data. I'm most curious about how to approach the research questions in the softer way that a sociologist might-Hutching's "What is?" approach that may not yield statistically valid results but is still useful.

Assignment #4: Annotated Bibliography

Joanne Rampersad-Ammons
University of Texas – Pan American, Edinburg, TX

Assignment #1: Introductions

1) Describe your teaching responsibilities and the type of student you teach,.

I teach a variety of courses in the Chemistry Department as follows:

- General Chemistry 1- this is for Science, Allied Health, some Engineering and non-science majors. Class size ranges from 60 to 100 students who are mostly freshmen.
- General Chemistry 2- this is for Science, Allied Health, some Engineering and non-science majors. Class size ranges from 60 to 100 students who are freshmen in their second semester.
- Introductory Biochemistry- the majority of the students are Chemistry and Biology majors with a few Engineering majors and many Biochemistry minors. Class size ranges from 60 to 70 students who are mostly juniors or seniors.
- Introductory Biochemistry Laboratory- The lab accompanies the lecture but is run as a separate course and is not required if taking the lecture. The majority of the students are Chemistry and Biology majors with a few Engineering majors and Biochemistry minors. Class size ranges from 15 to 22 students who are mostly juniors or seniors and usually 2-3 sections are run per semester.
- Advanced Biochemistry Laboratory- This is a research oriented laboratory course that I am currently developing that teaches students various skills that are useful in a molecular biology/research environment. The majority of the students are Chemistry and Biology majors with a few Engineering majors or Biochemistry minors. Class size ranges from 10-15 with students who are mostly seniors. At the moment, one section is run per year, however when we get our Biochemistry major approved, this will be a required course.
- General Chemistry for Non- Science majors- this is a course that I am developing. There is a very high failure rate in our General Chemistry courses, since science and non-science majors are put together. It is our hope that pulling out the non- science majors from the rest of the group will allow us to tailor the two courses to the needs of the specific student groups.

Our students are mostly Hispanic with many of them being first generation college students. Many of our students or their parents are recent immigrants. The language of instruction is English, but Spanglish is usually what you hear in the corridors. We live in an area which we call Mexus (a blend of Mexico and Texas) since we are south of the Falfurias Checkpoint but north of the Border.

2) Describe what you would like to take home as a result of attending the SoTL Institute.

One of my research areas is undergraduate research education. A significant amount of resources is put into undergraduate research experiences, but the literature to support the benefits of these experiences is mostly anecdotal. In addition, many of us believe that to get students really excited about science in the laboratory, we need to move away from cookbook labs and incorporate our research into the lab experience. The question is how to get that done. We have been experimenting with a research network model that is facilitated by two software programs that assist with managing the students and the data that they generate. I would like

from the Institute, two things: 1)a group of scholars from diverse backgrounds, who I can use as a 'sounding board' for bouncing ideas around as we develop the model and 2)a clear understanding on how to formulate testable hypotheses given the difficulty in running controls for this kind of research. Judging from the letters of introduction that have been written so far- I can see that I will not be disappointed. My bonus take home will be all of the new ideas/ways of thinking/ approaches that I will be exposed to as part of the program. Fun! Fun! Fun!

3) Tell us about your interests outside of the classroom and a book that you have read recently.

I love to watch my husband's garden grow when it is cool enough. We do get 'hotter than hell' during the summer months and have very low rainfall then as well. This takes its toll on all but the hardiest of plants. We have a dog that borders on being delinquent, and a turtle that lives in our 'pond' which is all of about 4 feet wide. The pond attracts all kinds of birds- year round which are always fun to watch. As far as books go, the last nonfiction one that was a lot of fun was 'Working with emotional intelligence' by Daniel Goldman. I just skimmed through 'The Underachieving Child' which was interesting. For 'turn off your brain fiction reading', I read a lot of my 12 year old son's books. He has started 'The 39 clues' series and for the summer I want to go through 'The lightening thief' and others in the series that he really enjoyed.

Assignment #2: Reflections

1) How would you describe your "research problem(s)" to the Research Scholars group?

As a new faculty member at a primarily undergraduate minority serving institution, my biggest challenge involves effectively managing my undergraduate student researchers. This is a challenge all new faculty must surmount. Many of us believe that exposing students to 'real research' does wonders in enhancing their skills, and for this reason we would like to bring our research into the teaching laboratory via inquiry-based laboratories- but what exactly is required to effectively mentor large numbers of undergraduates at the same time?

2) What theme(s) based on your readings, resonate with your "problem" and/or your proposed approach to address your problem.

For several years, I have been working with a collaborator on testing ideas to address this challenge. In order to manage student research activities, I am using a three component system: 1. Establishment of a research network/community which spans the research and inquiry based teaching students; 2. Using management software (Student Research Organizer) to document and manage the activities of the network; 3. Using data tracking software to document and manage the data collection activities of the research network where all members of the network have access to the data being generated so that they can start asking/answering their own questions.
In order to evaluate what we are doing, I would like to begin a systematic assessment of these components. This is my primary reason for joining the Biology Scholars program- to learn 'how to'.

3) Based on Pat Hutchings article, what taxonomy would you use to describe your research question and why?

these really stood out to me not necessarily for tackling my challenge, but for getting me to where I want to be.

From Randy Bass-1. ‘Teachers need to know more than just their subject. They need to know the ways it can come to be understood, the ways it can be misunderstood, what counts as understanding: they need to know how individuals experience the subject.’ I think of this as a lifelong goal.

From Pat Hutchings- 1. Investigation ‘changes the role of students, making them more active agents in shaping and examining the processes of teaching and learning. Indeed, the involvement of students in the doing of the scholarship of teaching and learning—as co-investigators and agents, rather than as objects’, 2. “I want to understand more about how I can help students see themselves as part of the wonderful process of understanding the world around them and their position in it.”

From Gwynn Mettetal- 1.‘every teaching situation is unique in terms of content, level, student skills and learning styles, teacher skills and teaching styles, and many other factors. To maximize student learning, a teacher must find out what works best in a particular situation.’ 2. ‘Validity is achieved through the triangulation of data.’

Taxonomy
Perhaps one of the ways to make significant progress with my problem/challenge is to ask ‘what works’. In building our investigations I would like to build ‘new models and conceptual frameworks to generate new questions that can, in turn, enrich the scholarship of teaching and learning and extend its boundaries’. The use of tracking software opens up the possibility of being able to document events and provides a framework for a common platform that may allow us to monitor how students are changing as their research experience unfolds.

4) Do you have any questions/concerns/comments that have evolved from your reading?

It has taken me a while to sort out my thoughts- as I read the articles, by mind was constantly fluttering about all of the courses that I teach and it was difficult to focus on my challenge. I was like a kid in a candy store, drooling over all of the possibilities. I also realized that I have been doing a lot of “change the script as you go” and not conducting full-fledged “design experiments” which is an essential part of the process if I am to communicate my results. I have been trying to “strike a balance between rigor and flexibility” and to let the investigation “unfold and take shape as the course itself, as well as the students’ experience, unfolds and takes shape’. While this will suffice as a good strategy for my general teaching, and will ease my conscience, (I was beginning to feel guilty for not being rigorous all of the time), it will not cut it if I really want to make a difference and do something concrete to tackle my challenge. As I was mulling over all of this, I had a mini epiphany- to be committed to the Scholarship of Teaching and learning means that I will be always a learner- the thought is exhilarating. How do I now persuade my students to begin their own lifelong quest on the Scholarship of Teaching and Learning?

Assignment #4: Annotated Bibliography

This short bibliography pertains to the broad field of Undergraduate Research Education and more specifically literature that looks at undergraduate research experiences (URE) so that I can begin to see if anything exists on my large research question of ‘How does student management software impact undergraduate research experiences’. Thus far, it appears that the idea of student management software or even of focusing on ‘strategies to aid in mentoring large numbers of undergraduate research students' does not exist. Some literature exists on the benefits of UREs and so this may be the place to start for assessing how the software that we are developing will impact the URE. Some literature also exists on challenges to undergraduate

research mentoring. This can be used to provide a rationale for using the software and perhaps can be developed into an assessable research question.

Sadler, T.D. & McKinney L. (2010). Scientific Research for Undergraduate Students: a Review of the Literature. *Journal of College Science Teaching 39*, 43-49.

This is an important article since it is a comprehensive review of 'empirical studies of undergraduate research experiences in order to critically evaluate the outcomes of these efforts'. This article helps us to set the stage for the work that we want to pursue and it also gives concrete ideas for what gains may be measured for UREs. It focuses on learning outcomes such as career aspirations, confidence, nature of science, intellectual development, content knowledge and skills. Since my research question looks at impact, then focusing on these key areas will help to build the knowledge in that area.

Crowe, M. & Brakke, D. (2008) Assessing the Impact of Undergraduate-Research Experiences on Students: An Overview of Current Literature. *CUR Quarterly*, *28* (4),43-50.

Article is available online at (http://www.cur.org/quarterly/jun08/summer08CroweBrakke.pdf) (Accessed April 20, 2009). This is one of my favorite articles since it gives a review of the impact of undergraduate research experiences and underscores the flaws in many studies and critically assesses the state of research in this area. This is a wonderful article for quoting as it critically looks at the state of URE and our knowledge of it.

Wenzel, 2003. Enhancing Research in the Chemical Sciences at Predominantly Undergraduate Institutions, A report from the Undergraduate Research Summit. (http://abacus.bates.edu/acad/depts/c...el/summit.html) (Accessed April 20, 2009).

This is an interesting article although a bit old. This was the result of a summit of PUIs and give some insight into the problems and pitfalls of undergraduate research at these institutions. There is a lot of commonality with the sentiments raised and the state or my institution-so it is a good background reference for putting my work into context.

U.S. Department of Education, Report of the Academic Competitiveness Council, Washington D.C. 2007. (http://hub.mspnet.org/index.cfm/14287)

This is an important reference since it is looking broadly at STEM education and the pitfalls on a national basis- 'Officials from federal agencies with education programs aimed at improving America's competitiveness in science, technology, engineering, and mathematics (STEM) engaged in a yearlong endeavor to assess their programs' success and to identify areas for improvement for current and future programs. This effort, carried out by the Academic Competitiveness Council (ACC) and led by Secretary of Education Margaret Spellings, lays the groundwork for sustained collaboration among STEM education programs across federal agencies that will greatly strengthen America's competitiveness.'

Adedokun, O.A., Dyehouse, M., Bessenbacher, A., & Burgess, W. D. (2010). Exploring Faculty Perceptions of the Benefits and Challenges of Mentoring Undergraduate Research, Paper presented at the Annual Meeting of the American Educational Research Association (Denver, CO, Apr 30-May 4, 2010)

This paper notes that 'the involvement of undergraduate students in the research process has evolved from a "cottage industry" into "a movement" '. UREs are increasingly becoming a critical component of baccalaureate STEM education. This paper notes that the literature focuses on 'the benefits to students' with little or no examination of the benefits and challenges to participating

faculty'. Using the cognitive apprenticeship model as a theoretical framework, descriptions of the benefits and challenges accruing to faculty are drawn from analysis of their responses to open-ended questions. Of significance to my work is the question 'What challenges did you encounter in your involvement in the UR experience? The faculty (45%) recognized Timing and scheduling seem to be the greatest challenge that faculty faced. In addition they recognized the other academic commitments of the students and the challenges of scheduling research activities around students' classes. This is a good plug for some of the benefits of student management software to addressing these challenges.

Other relevant references to the area:

1. Lopatto D. 2007 Undergraduate research experiences support science career decisions and active learning. CBE Life Sci Educ. 6:297-306. Follow up to Lopatto D. 2004. Survey of undergraduate research experiences (SURE): First findings. Cell Biology Education 3:270-277.
2. Lopatto is one of the few investigators into evaluating UREs on a large scale using HHMI funded UREs.
3. NSF funded URE opportunities ' Research Experiences for Undergraduates' (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517&from=fund) (Accessed April 20, 2009)
4. National listing of URE Programs (http://www.the-aps.org/education/ugsrf/SumResLINKS.htm) (Accessed April 20, 2009).
5. STEM Education Coalition (http://www.stemedcoalition.org/) (Accessed April 15, 2009).
6. The National Conferences on Undergraduate Research (NCUR) (http://www.ncur.org/ugresearch.htm) (Accessed April 20, 2009).
7. NATIONAL COLLEGIATE INVENTORS AND INNOVATORS ALLIANCE, 2006 conference, Institutionalizing Entrepreneurship at Primarily Undergraduate Institutions, (http://www.nciia.org/conf_06/papers/pdf/kussmaul.pdf) (Accessed April 20, 2009).
8. Adhikari, A. and Nolan, D. 2002. But "What Good Came of It at Last"?: How to Assess the Value of Undergraduate Research. Notices of the American Mathematical Society, Vol 49, no 10, pg 1252 to 1257. (http://www.ams.org/notices/200210/comm-nolan.pdf) (Accessed April 20, 2009).
9. NSF 02-057: The 2002 User-Friendly Handbook for Project Evaluation, a basic guide to quantitative and qualitative evaluation methods for educational projects (http://www.nsf.gov/pubs/2002/nsf02057/start.htm) (Accessed April 20, 2009).
10. NSF 97-153: User-Friendly Handbook for Mixed Method Evaluations, a monograph "initiated to provide more information on qualitative [evaluation] techniques and how they can be combined effectively with quantitative measures" (http://www.nsf.gov/pubs/1997/nsf97153/start.htm)
11. Online Evaluation Resource Library (OERL) for NSF's Directorate for Education and Human Resources, a collection of evaluation plans, instruments, reports, glossaries of evaluation terminology, and best practices, with guidance for adapting and implementing evaluation resourceshttp://oerl.sri.com/home.html
12. Field-Tested Learning Assessment Guide (FLAG): This website is designed for Science, Math, Engineering, and Technology Instructors who are interested in new approaches to evaluating student learning, attitudes, and performance. It has a primer on assessment and evaluation, classroom assessment techniques, discipline-specific tools, and resources - all in a searchable, downloadable database, http://www.flaguide.org/
13. Student Assessment of Learning Gains (SALG): An on-line survey that measures student perceptions of their learning gains due to any components within a course. Faculty can modify a template to match any and all features of their courses, have their students take

the survey on-line, and have the data returned to them as either raw data or with simple statistical analysis, http://www.salgsite.org
14. Bunce, D., and Cole, R. 2008 Nuts and Bolts of Chemical Education Research (An American Chemical Society Publication, Oxford University Press.
15. Grabowski, J. J. , Undergraduate research efficacy web page, http://cwt4.chem.pitt.edu/ugrad/reu/efficacy.htm (Accessed April 15, 2009)

Susan Sullivan
Louisiana State University at Alexandria, Alexandria, LA

Assignment #1: Introductions

1) Describe your teaching responsibilities and the type of student you teach.

I teach the entire spectrum of students major to non-major, freshman to senior. I find this a bit challenging at times but I love the variety.

a) *Biochemistry is a senior level required course for majors taught yearly, no lab
b) *Genetics is a junior level required course for majors taught yearly with recitation, no lab
c) *Cellular and molecular biology is a sophomore level required course for majors taught yearly, no lab
d) Microbiology is a sophomore level course with both majors and allied health students, taught each semester, (+some summers), with a lab
e) General Biology is a freshman level course for majors that I will teach for the first time in Fall, with a lab
f) *Immunology is a senior level elective for majors, every other year, no lab
g) *Cellular and Molecular Techniques is a junior level elective, every other year, lab only
h) Intro to Biology is a freshman level non-majors class, taught every few years, no lab
i) Introductory Biology Lab I, is taught to freshman non-majors every few years as only a lab
j) Biological Research is taught to upper level biology majors interested in directed research projects. I usually direct one or two students in research per semester.

Courses listed above with an * indicate those for which I am the only instructor for the course. We rotate other courses as our schedules and expertise allow. We teach 12+ contact hours per semester. Biological research is not part of our teaching load.

2) Describe what you would like to take home as a result of attending the SoTL Institute.

I spend much of my time teaching, yet most of my training was to develop excellence in the research field. I have spent the past few years actively engaged in seeking out and employing different techniques in my classrooms. In addition, our campus has recently established a center

for teaching excellence. We are using the center to learn from one another and from the conferences/ materials that we are gathering.

Lacking from the mix is the ability to quantify or evaluate the efficacy of the methods we are trying. From the perspective of a scientist, it seems a bit like hunting and pecking and not knowing if you got the worm or a rock! I can only be truly effective if I can determine which methods are useful for my students and which are not. Simply put, I want to develop my abilities as a scholar of teaching and learning, and I want to bring that back to our campus.

3) Tell us about your interests outside of the classroom and a book that you have read recently.

I quilt, often for charity (so I don't have to see my mistakes when I'm done). I love gardening and I grow weeds very well indeed. I am also active in my daughter's (7 yrs old) school and our church. Sometimes I get to enjoy a good nap.

I have read a few books recently. I am currently reading a book of excerpts from the teaching of Mother Teresa. Lest you think I am too good; the last two "The Borgia Bride" and a Kay Scarpetta mystery novel were not so noble. I have also recently read a couple of novels by Jody Piccult.

Assignment #2: Reflections

I want to first say that this was the most difficult for me. I have lots of "what works" questions about my classes and was approaching this as the students having a learning problem that I should fix and then prove that I had fixed it. As I struggled with which of their "problems" to address I was overwhelmed by which class or problem was the most important. It took me a long time to come to a change in my approach to this. I wonder what struggles others have had.

My problem has evolved into trying to evaluate how I want to approach teaching my introductory course for biology majors. It strikes me that my colleagues and I tend, as do most faculty, to approach the course as a set of information to be mastered by the student. As I struggled with how to get specific information to them in the most efficient and comprehendible way,, I decided that for this course especially I should consider spending my efforts on teaching the students how to learn biology and hopefully the learning of specific material will come. I am embarrassed by this as a revelation, as it seems so obviously in line with the scholarship of learning, that I wonder how I kept on missing it before.

The problem I've noticed in other courses I have taught (I have not taught the introductory course before) is that students seem to not know what to study or the way to prepare for the types of questions on they will see on exams where I tend to ask a fair number of higher order analysis type questions. Post test feedback includes students saying that the "knew the material but couldn't answer the questions" or that they did not think we had covered the material. This has left me puzzled and I have tried many approaches to rectify this. Topical study guides and in-class prompts of material that will be included on the exam have not seemed to have helped sufficiently, though I have not tested this supposition. I have students use on-line discussion boards to post possible test questions and answers, which I then critique and refine, giving students my logic for why I might or might not use those questions. What troubles me though is that some students sincerely think they know the material and don't. Are they unprepared for the type of question, or did they have a false understanding or misconception of the material? Do the students not know that they don't understand the material until they take the exam or are they perhaps just hoping the information that they struggled with wouldn't be on the exam?

Perhaps if students are studying the material in the ways that have worked for them in their academic past they are frustrated that these same methods: memorizing definitions of key words, and writing lists of attributes, are no longer bringing them success. In my classes I have spent the first lecture telling them how to study for the course but felt that was all of the time I could devote to the subject. I am excited to think about restructuring this first introduction to their collegiate science career to maximize their understanding of *how* to learn.

As I read the assigned articles several themes resonated either with me or my research question. First, the concept of intentional approaches to every aspect of the course resonated with me because this is something I have sought to do but my intentions lack the follow-up of evaluation. The point that outcomes and analysis are an integral part of teaching was not something I had given much thought to before. I see that my scholarship was missing these very critical evaluative steps. This reminded me of a question that had been posed to me at a science teaching mini-symposium. The question way why don't scientists approach the study of teaching and learning in a scientific way? Good question. I am also reminded that intentional approaches take time and a continuity of effort.

A second resonant theme from the Bass article was questioning how students come to know or understand the material for a given course. I think I have failed to ask this question when preparing my courses. If we cannot answer this then we cannot know how to best present the material.

Along with this, I realize that I think I understand a problem my students are having but I also have failed to test my assumptions about a problem prior to trying to solve it. My "solutions" have tended to rely on familiar tools rather than something designed specifically to align with the particular problem.

Based on the Pat Hutchings article I think my problem fits into the type I "what works" because it is driven by a desire to improve specific improvement in students understanding of the material and as I think about measurement of success, I realize that my approach is looking for proof in improved student test scores. (I may need to rethink this. I feel like such a novice in my conceptualization!) I also think this fits with a type IV problem because this would be looking at a potentially different approach to teaching learning rather than material per se.

My main concerns are how to achieve clarity for the specific problem I will tackle and which methods I can use to obtain data about the problem and the efficacy of approaches to solve the problem.

When is mastery the goal over content knowledge, are we testing appropriate to the goal
Is understanding the most important goal, why, is practical memorization just as or more important for intro courses? When should understanding be the goal?
Intentions for student learning must be transparent to the students, what am I doing to promote their learning? Make them self-aware of the learning process itself

Assignment #4: Annotated Bibliography

This annotated bibliography is designed to include article on improving how students assess their knowledge of the material and structure their learning. I want to try using formative or pre-assessments to get students to understand their own misconceptions of the material, their pre-knowledge of the material and to get a feel for the depth of which they will need to understand the material for success on the summative assessments. Therefore, I need to obtain data on the

efficacy of formative assessments, best practices in structuring formative assessments and on evaluating the efficacy of formative assessments in student learning.

Cliff W, Freeman S, Hansen PA, Kibble JD, Peat M, and Wendroth MP, "Is formative assessment an effective way to improve learing? A symposium at Experimental Biology 2008", Adv Physiol Educ 32:337-338, 2008.
http://advan.physiology.org/cgi/reprint/32/4/337

This article deals with using the formative assessment as a tool to determine student deficiencies and misconceptions. This is a direct link what I would like to try with my students to help them identify areas of weakness prior to their summative assessments. This article is useful in both its topic, scope, and the references that it contains and represents a base of work on which I would like to build.

Dobson J, "The use of formative online quizzes to enhance class preparation and scores on summative exams", Adv. Physiol. Educ 32: 297-302, 2008
http://advan.physiology.org/cgi/reprint/32/4/297

This article also is a study on which I would like to build. I like the prospect of using online formative evaluations for two reasons; online evaluations do not take valuable class time; and students can potentially re-assess as needed. It will be good for methods of evaluation as well.

Kibble, JD, "Use of unsupervised online quizzes as formative assessment in a medical physiology course: effects of incentives on student participation and performance", Advan. Physiol. Edu. 31:253-260, 2007.
http://advan.physiology.org/cgi/content/full/31/3/253

Cautions and solutions for students misuse of formative assessments when incentives are used. Some things to think about….

ERIC #: EJ880311
Goubeaud K, " How Is Science Learning Assessed at the Postsecondary Level? Assessment and Grading Practices in College Biology, Chemistry and Physics" J Sci Educ and Tech 19(3):237-245, 2010.

Hopefully useful as I learn more about effective methods for formative assessments.

ERIC #: EJ877801
Rossiter D, Petrulis R, and Biggs C, "A Blended Approach to Problem-Based Learning in the Freshman Year" Chemical Engineering Education 44(1):23-29, 2010
Web site: http://cee.che.ufl.edu/index.html

Designing intentional learning combining lecture, online and active learning techniques. Hopefully a resource for pulling it all together.