TEAM #3

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Holly Ahern
Adirondack Community College, Queensbury, NY

Assignment #1: Introductions

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

I am an Associate Professor at Adirondack Community College, which is a part of the State University of New York (SUNY) system. The college is small and does not have a great deal of cultural diversity, but my students are an interesting mix of traditional and non-traditional college students, about half of whom will ultimately transfer to 4 year institutions. My primary teaching responsibility is Microbiology for science majors and health science (including veterinary) majors. The rest of my load consists of a non-majors biology lab science course, and may also include Genetics, Molecular Biology, and Organic and Biological Chemistry, which are taken mostly by transfer students.

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

My main research interest is the role of assessment in learning - actually, I am intrigued by thoughts of what actually constitutes "learning" and how best to assess it. Assessment is also becoming a big concern for colleges within the SUNY system (and elsewhere apparently, since some of you seem to have similar interests!), so I hope that I might be able to contribute to the college's assessment efforts, as well as publish my findings.

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

Lately I'm finding myself wondering if there is an "outside" of the classroom, but when there is I am usually outside, and living near the Adirondacks and beautiful Lake George provides me with a huge playground. I am married, have two children, one in college and the other one on her way in the fall (ouch), two cats, and a horse.

Geek that I am, I enjoy reading and writing about science and history, particularly when they merge. I recently finished "Ship Fever" by Andrea Barrett. I also love to read anything by Robert Parker, Lincoln Child (with or without Douglas Preston), and Rita Mae Brown (the animals tell her stories).

Assignment #2 Reflections

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

Of greatest interest to me at the moment is the problem of student assessment. Over the course of several years during which I have changed my teaching methods and attempted several different means of assessment, I have noted very little deviation in overall class averages; most classes, in fact, conform to a standard statistical "bell curve." This observation raises several potential research problems, not the least of which is what differentiates the students at the top of the curve to those near the bottom. Currently I feel that it is a combination of factors, which I have divided into two groups: student factors and teaching factors. In my classes, student factors appear to include both innate abilities (such as reading comprehension skills) and external factors (family, jobs, etc.). I have noted that student commitment to learning (as evidenced by class attendance, participation, and interest) is proportional to student grades as well. Of interest (and perhaps concern) to me is that the literature I've been reading does not seem to differentiate among learners in general, treating them as a collective whole

On the other side are the teaching factors. One of those factors is the assessment instruments used to measure learning. Because the observed bell curve appears to be consistent across semesters (which for me includes spring, fall, and two summer sessions) I have to question if my assessments of student learning are truly authentic, or if they reflect some inherent bias on my part.
Thus I would like to try to develop an assessment instrument that (1) is directly related to the learning objective that I value most (after consideration of exactly what that will be), (2) provides a measurable outcome that can also be used to satisfy college, university system, and accreditation requirements of course, and (3) is an authentic assessment of student learning.

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

What resonated most for me in the reading assignment was Randy Bass' discussion of his journey from a teacher with questions to a researcher investigating a set of problems. I particularly liked the idea of breaking down the teaching factors influencing grades into a series of smaller problems, that can investigated over time, in a scientific way with measurable outcomes that can be used for objective analysis. I have concerns that this type of research, like grades, might be subject to inherent bias on the part of the investigator, since I will actually be investigating me!

3) Which of the 12 properties of SoTL in microbiology education proposed by S. Benson's article are particularly relevant to your project at this stage?

Finally, at this stage, I believe that Benson's 1st, 4th, 8th, and 12th properties are particularly relevant to my project.

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

5) What do you see as tangible products to be developed as a result of your Scholars experience within the next 12 months?
As my "product," I would like to have developed an authentic assessment "product" that can also be used to satisfy college, university system, and accreditation requirements, that could be presented at AMSCUE.

6) What do you see yourself presenting at the follow-up session at ASMCUE 2009?

7) What will you need to develop these products?
I believe that I will need some guidance in this area, particular the methods used to conduct this type of research objectively.

Assignment #3 Annotations

Although there were many articles dealing with my research interest (assessment), very few were related to assessment of science courses and even fewer regarding the assessment of community college students. The following articles, however, did provide some very interesting insights.

1. McDowell, L., Smailes, J., Sambell, K., Sambell, A., and Delia Wakelin (2008) Evaluating assessment strategies through collaborative evidence-based practice: Can one tool fit all? Innovations in Education and Teaching International
   45(2): 143-153.

This article reports on a project undertaken by faculty in three different academic areas in which an "action research approach" was used to gather data with an existing data collection tool, which was then analyzed in a collaborative manner (one of the academic areas was Psychology). The team used an existing instrument (the AEQ) administered to students who essentially assessed the assessment practices in individual classes. The net result was that one assessment tool does not fit all but is context-driven. It was also interesting from the perspective of steps taken toward moving (perhaps less than enthusiastic) university faculty away from traditional and toward formative approaches to assessment.

2. Ebert-May, D., Batzli, J., and Lim, H. (2003) Disciplinary research strategies for assessment of learning. BioScience 53(12): 1221-1228.

A science research approach to assess students' understanding of a core topic in biology (the carbon cycle) was discussed in this article. In addition to providing a detailed methodology, the authors also put out a "charge" to other scientists in education to rethink traditional assessment approaches and to conduct their own classroom based research (in strong support of SoTL).
Interesting, their research was funded (in part) by grants from the NSF and HHMI, also supporting the concept of teaching and learning as a scholarly pursuit.

3. Payne, S.L., Flynn, J., and Whitfield, J.M. (2008) Capstone business course assessment: exploring student readiness perspectives. Journal of Education for Business Jan/Feb: 141-146.

This was one of several articles I found regarding assessment in business, which was an interesting finding in and of itself. The researchers were concerned primarily with student readiness for a capstone business course, and used what they termed a feed-forward approach, in which the retention of basic core principles by students in pre-requisite course was studied. Students in those courses were tested at the time a core principle was presented, and then again at the end of the course. They found that in general there was a significant lack of knowledge retention of the foundation principles necessary for success in a capstone course. This is of particular interest to me because I assume prior knowledge (from pre-req courses) of concepts such as metabolism and genetics when I teach Microbiology, and those are typically the areas in which student averages on tests are the lowest. This is an experiment I would like to repeat with my own students.

4. Wilson, M. and Scalise, K. (2006) Assessment to improve learning in higher education: The BEAR assessment system. Higher Education 52: 635-663.

The BEAR system was developed by the Berkeley Evaluation and Assessment Research Center and was designed as a comprehensive, integrated system for assessing, interpreting, monitoring, and responding to student performance. The system relies on the use of “embedded” assessments and discusses the concept of formative assessment, which took me off to search the term formative assessment. There is a preponderance of articles (which I have not included in this bibliography) that collectively indicate that formative assessment instruments enhance student learning and are clearly superior to summative assessment tools. Since I already use both summative and formative assessments in my microbiology class, I started to think about my own “data” in this area, which indicates that students consistently achieve lower “grades” on summative assessments (ie lecture exams), and get higher “grades” on projects that are evaluated using rubrics (a type of formative assessment). But, which is an authentic measurement of student understanding? Are students truly gaining a deeper understanding of microbiology, as indicated by the results of the formative assessment tool, or is there an inherent bias in the way such projects are assessed, resulting simply in higher grades? How do I “assess” that?

5. Smith, Gary (2007) How does student performance on formative assessment relate to learning assessed by exams? July/Aug: 28-34.

This was my “capstone” article – an analysis of formative and summative assessment strategies in two undergraduate geoscience courses. Grades from formative assessment projects were correlated with grades on “infrequent” exams and relationships were found, although conclusions were considered tentative because there were no control groups or efforts to limit external variables.
The data presented in this article mirrored my own informal observations, and will form the basis of my research.

Patricia Baynham
St. Edward's University, Austin, TX

Assignment #1: Introductions

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

I teach at an undergraduate liberal arts Hispanic serving institution in Austin, TX: St. Edward's University. My students (and the classes that I teach) include both biology majors (freshman biology, microbiology with lab, research methods, senior seminar) and non-science majors.

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

In attending the SoTL Institute I hope to learn to analyze the effectiveness of my teaching approaches. There is much emphasis at SEU on student evaluations as a source of information regarding how courses should develop. However, I believe that a more objective source of information will be helpful in determining what most positively impacts student learning.

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

Personally, I love orchids, enjoy yoga and am involved in the trap-neuter-and-release of feral cats in my neighborhood. I am married to a wonderful man (no children). A book I very much enjoyed reading is "Eat, Pray, Love" by Elizabeth Gilbert.

Assignment #2 Reflections

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

I teach at St. Edward's University a Hispanic serving institution in which most biology majors plan to pursue medicine. It is a challenge to find ways to challenge them to consider other alternatives during their college years when they could easily change course. I want to know if having students read about scientists in a humanizing way can help them to consider a career in research. I will have my freshmen read a selection of essays or chapters that humanize scientists and see if this has an effect on their career choices.

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

Although not a scientist, Bass's perspective was very helpful. I like that the emphasis is on the question rather than on quick solutions. He does not advocate a knee-jerk reaction to student evaluations in order to placate students and administrators but a more careful analysis of the problem. Although my question is a relatively simple one Bass indicates that this is worthwhile and that it would be impossible to analyze all aspects of teaching at once. SoTL does not tie the educators' hands by requiring in-depth work on every facet of teaching from each educator but frees us to ask questions about the issues that we see as most pressing in our own teaching with our own students. This was reassuring to me.

3) Which of the 12 properties of SoTL in microbiology education proposed by S. Benson's article are particularly relevant to your project at this stage?
Of Benson's properties of scholarship of teaching the ones that seem most relevant to my problem are:
6. It stimulates intellectual exchanges among microbiology educators.
7. It is public; it is work that is shared with peers at all stages of its development. I have already interacted with faculty at the CUE in order to improve my chances of adequately testing my question.

4) Do you have any questions/concerns/comments that have evolved from your reading?
From my reading I can see that there are many different sorts of questions being asked. I am looking forward to discovering if there are different places to publish these various studies or if SoTL is so new that these studies are published with dissimilar studies. Our natural science topics are divided into extremely specific sub-topics and I imagine it may or may not be the same in SoTL.

5) What do you see as tangible products to be developed as a result of your Scholars experience within the next 12 months?
If these did have a positive effect (on students' career aspirations) then I would like to publish these in the curriculum resources of Microbelibrary. It is possible that this would be helpful for other educators. At the conclusion of my study I would like to publish these data in a peer-reviewed journal but this will likely take more than one year.

6) What do you see yourself presenting at the follow-up session at ASMCUE 2009?
At the 2009 ASMCUE I hope to present data regarding how the readings affected my students' career aspirations (or perhaps how they did not).

7) What will you need to develop these products?
I am in the midst of reading a number of books suggested by faculty at the 2008 ASMCUE. In order to effectively ask my question I will need to find readable books that embrace scientists of various backgrounds and ethnicities. Like everyone else I imagine the greatest resource that I need to complete this project is time!

Assignment #3 Annotations

I want to know whether students of any ethnicity/gender will be convinced to consider a research career through reading humanizing stories of various scientists (also of various ethnicity/gender). I also want to find evidence of whether or not women and minorities are under-represented in scientific research careers. My assumption has been that they are under-represented but I want more specific evidence. I also want to know what others had done in an attempt to show students that research is an option for them. Has anyone previously measured the effect of popular literature on career choice? What other strategies have been attempted?

1. National Science Foundation. (2007). Women, Minorities, and Persons with Disabilities in Science and Engineering: NSF 07-315. Washington, DC: National Science Foundation (http://www.nsf.gov/statistics/women/).

This contains the most recent statistics regarding education and employment of various groups of people in science and engineering. The inequity is largest at the employed doctoral degree level. Seventy-five percent of such scientists are white while black and Hispanic scientists make up just 3.5% and 3% respectively. While over half of undergraduate biologists are women there are twice as many males employed as faculty in every Carnegie classification.

2. Porta, Angela R. (2002). Using Diversity Among Biomedical Scientists as a Teaching Tool. The American Biology Teacher 64 (3): 176-182.

This was a clever idea in which students in a Cell Physiology class at Kean University designed a questionnaire and were assigned various scientists that they requested to complete the questionnaire. Then each student presented his/her assigned scientist's responses to the class. This introduced the concept of diversity in scientific research and made the students realize that anyone can do science and not just white men in lab coats. This article also talked about the importance of role models.

3. Luckenbill-Edds, Louise. (2002). The Educational Pipeline for Women in Biology. Bioscience 52 (6): 513-521.

This paper looks at the progress that women have made in biology with regard to choice of major and advanced schooling and employment. They have reached parity in choosing a major but not in advanced schooling and employment. The author suggests that there may need to be a change in the culture of science in order to be more inclusive. The weed-out model is said to discourage both males and females.

4. Fallon, Diane. (2003). Accepting, Embracing and Striving: Describing Student Responses to Diversity Issues. CASTL Program, Carnegie Foundation (http://www.carnegiefoundation.org/programs/sub.asp?key=21&subkey=63&topkey=21).

This was a project from an English professor in a community college. She tried an activity to stimulate students to broaden their views on diversity and found that sometimes this was only a temporary change and they then fell back on more simplistic views. This cautions me to follow-up on students after the semester in which I gather data. When I ask them about their perceptions of diversity in science this may be a temporary opinion and may not impact their career choices in the long term.

5. Salmela-Aro, Katariina and Jari-Erik Nurmi. (2007). Self-esteem during university studies predicts career characteristics 10 years later. Journal of Vocational Behavior 70: 463-477.

This Finnish study looked at over 200 students and determined their level of self-esteem and correlated this with job satisfaction and success. Those with higher self-esteem had a more stable and successful career (at least over the short term of the study). While I could find nothing about why students make the choice to pursue scientific research I have seen info regarding the importance of role models. I can imagine that having role models more like oneself would increase confidence and self-esteem and lead to increased success. I may want to include questions to

assess students' self-esteem before and after reading the popular scientific literature.

Samantha Kerry
St Mary's College of Maryland, St. Mary's City, MD

Assignment #1: Introductions

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

I am a tenure-track Assistant Professor of Biology at St. Mary's College of Maryland, which is a small public liberal arts college. Because we are a public institution, we get a fair number of minority and first-generation college students. I team-teach our first year Principles of Biology I course (including lab) with approximately 150 students divided into 2 sections, upper level courses in Immunology and Cell Physiology (including lab) with a maximum of 16 students, and a non-majors Forensic Biology course (including lab) with approximately 30 students. I also supervise 6 senior undergraduate research students during the year, and 1-2 other research volunteers or independent study students. While teaching is my main focus, I am still active in the laboratory. (Well…my students are, at least until the summer months when I'm free to run experiments!)

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

This is the end of my second year here at St. Mary's. I've been attempting an assessment of my teaching effectiveness over the past year, and the experience has taught me that I have a lot to learn! So, I'm hoping to learn how to properly set up my classroom assessments and other general "good practices" for education research at the SoTL Institute.

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

When I have some spare time, I enjoy mostly "quiet time" to escape from the craziness of work. I like to read, watch TV/movies, and spend time with friends. The book I've finished most recently was the same as Trish: "Eat, Pray, Love" by Elizabeth Gilbert. Not my usual type of reading (which typically involves—as Bethany put it—"pure mind junk"), but it was excellent.

Assignment #2: Reflections

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

To introduce the topic of immunology to my classes, I have them role-play as cells of the immune system so that they can see how the various cells interact. The students have fun—but do they really learn anything? Is this method of delivery as effective as more traditional methods (i.e. lecture)? I have done some preliminary work looking at how effective the exercise is on classes of different sizes, and whether people who directly participate in the role-play learn more than those who simply watch their classmates. I am also interested in whether my students of different demographics (gender, race, level in school) learn differently during role-play simulations.

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

I particularly identified with Bass' teaching "problems" in the context of my own questions about my teaching. The article made me appreciate how systematic one must be to design and implement educational goals in the classroom, and test whether these goals are accomplished. To look at one's classroom as a research laboratory of sorts is an interesting viewpoint—one that I have obviously adopted (or I wouldn't have applied to the program!), but I didn't think fully about the parallels between the two venues. I also found Benson's description of teaching and learning relationships in the classroom thought-provoking, and it has me considering how much time I spend in each category. Nelson's article was interesting mostly because it made me wonder why he found that people outside his field provided more transformative ideas about teaching compared to those in biology. Is it that biologists are farther behind in SoTL? That making connections in SoTL from disparate disciplines creates a greater impact? Or that as biologists we often get into a "rut" of similar thinking about SoTL that is shaken up by observations from other disciplines?

3) Which of the 12 properties of SoTL in microbiology education proposed by S. Benson's article are particularly relevant to your project at this stage?
I see the potential application of many of the 12 properties of SoTL as proposed by Spencer Benson in the overall process that I hope to gain from Biology Scholars. However, at this stage of my project, #1 (reflection), #4 (building upon the work of others), #8 (problem centric), and #9 (principles of the field) are the most applicable. Throughout the course of the year, I am looking forward to sharing and discussing my work, which would incorporate a number of other properties from Benson's list.

4) Do you have any questions/concerns/comments that have evolved from your reading?
My main concern in addressing my "problem" is performing the proper controls to effectively address my question. I need to determine the appropriate methodology by reading SoTL literature. I also need to "catch up" on my reading to determine what has been done by others and where my project fits in. Upon reading the Institutional Review Board literature from my campus, I believe that my research does not need IRB approval. (But I'll be interested to discuss that with the group). Thus, I believe most of what I need requires a bit of time, legwork and direction (which I hope the Biology Scholars program can provide).

5) What do you see as tangible products to be developed as a result of your Scholars experience within the next 12 months?
Within the next 12 months, I would like to not only perform experiments to address my teaching "problem" and analyze the data, but to also write up my role-playing exercise for publication in MicrobeLibrary Curriculum resources.

6) What do you see yourself presenting at the follow-up session at ASMCUE 2009?
For ASMCUE 2009, I could present the data that I collect over the fall semester and/or a demonstration of the role-playing exercise. Eventually, I my goal is to publish my learning assessment data in an appropriate journal (JMBE or similar), though I'm not certain if that will happen in the next 12 months.

7) What will you need to develop these products?

Assignment #3: Annotations

1. Bealer, Jonathan and Virginia Bealer. (1996) Acting Out Immunity: A Simulation of a Complicated Concept. *The American Biology Teacher* 58(6): 360-62.

This article is the only one I've found that is similar to my own role-playing exercise. However, there are differences in approach between our two methods, and they did not include any data on the effectiveness of the exercise in the classroom. This is a good starting point for me to figure out what has been previously done and how to write-up my own exercise for other people to follow.

2. Aubusson et al. (1997) What Happens When Students Do Simulation-role-play in Science? *Research in Science Education* 27(4), 565-579.

This article looks at the use of role play to help students understand abstract scientific concepts at both the high school and college level. This is in direct contrast to many other educational role play exercises that I've found, where students pretend to be a specific scientist or advocate for a controversial scientific topic. Therefore, this paper matches much more closely to my own research goals. There are many references in this paper that will also be helpful to read. The introduction provides compelling arguments for the use of role play in education. However, much of the data presented in the article are anecdotal (comments from the teachers and students). Even data about follow-up exam questions are anecdotal, rather than statistical data.

3. McSharry, Gabrielle and Sam Jones. (2000) Role-play in science teaching and learning. *School Science Review* 82(298): 73-82.

While this article is primarily trying to encourage educators to attempt role-play in their classrooms, it provides excellent definitions of the different kinds of role-play exercises in scientific education, including seven specific categories (experiments, presentations games, simulation (moral/ethical role-play), analogy role-play, metaphorical role-play, and theater). According to these definitions, my exercise is an analogy role-play. It also discusses perceived difficulties in incorporating role-play in the classroom, which prevent educators from attempting it in the classroom.

4. DeNeve, Kristina M. and Mary J. Heppner. (1997) Role Play Simulations: The Assessment of an Active Learning Technique and Comparisons with Traditional Lectures. *Innovative Higher Education* 21(3): 231-246.

The authors used role play in an industrial psychology course to mimic a business (Board of Directors of a pizza company) and address problems associated with running that business on employee satisfaction and company success. Thus it is a quite different role play exercise than my own. I was originally very excited about this article, as I thought it would provide me with some direct methods for testing my hypothesis. However, this paper uses mostly student perception of learning (through use of surveys) rather than directly testing of learning outcomes using statistical data. It does provide a nice summary of effectiveness of "active learning" exercises in education at that time (1997), and indicate that while many of these studies did not truly test active learning compared to more traditional techniques, the few studies that did showed no real benefit (or detriment!) to the active learning

exercises. While it may be limited in helpfulness as to the actual structure of the study, I am including it in my bibliography at this point as an example of how others have tried to answer a similar question to my own.

5. McCarthy, J. Patrick and Liam Anderson. (2000). Active Learning Techniques Versus Traditional Learning Styles: Two Experiments from History and Political Science. *Innovative Higher Education* 24(4): 279-294.

Unlike the article above, this paper does provide statistical data to show increased learning in students who performed active learning exercises. In the history class, students in certain discussion sections participated in role-play debates compared to other sections that heard a more traditional lecture on the same material. In the political science course, one section of the class used traditional lecture, while the other section used group work to cover the same material. They used the exam as their method of testing learning outcomes. This article also gives a great summary of role play effectiveness as described by other authors (some of which are already listed in this bibliography).

6. Chinnici et al. (2004) Students as "Human Chromosomes" in Role-Playing Mitosis and Meiosis. *The American Biology Teacher* 66(1): 35-39.

In this article, the authors analyzed whether students (non-biology majors) who participated in the role-play had different learning outcomes compared to their classmates that did not participate. They found that students who did the role-play answered a higher percentage of bonus exam questions correctly compared to their classmates (55.1% compared to 47.9%), and that these differences were statistically significant.

7. Firooznia, Fardad. (2007). The Story of the Calvin Cycle: Bringing Carbon Fixation to Life. *The American Biology Teacher* 69(6): 364-367.

This article is the most directly relevant to my own students that I have found so far, because it deals with students in an introductory biology class. The author analyzed the exam outcomes of students who used a musical play to be introduced to the Calvin Cycle (and then were subsequently reviewed using lecture), as compared with students who learned by more traditional lecture methods. He found that students introduced to the material via the musical performed significantly better on the exam (90% mean score compared to 71%).

Lucy Kluckhohn-Jones
Santa Monica College, Santa Monica, CA

Assignment #1: Introductions

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

This semester I'm taking a banked leave, but in the fall I'll return to teaching an online hybrid microbiology course to allied health students most of whom want to be nurses. The students are wonderfully diverse, in just about every way imaginable, from a variety of national and ethnic backgrounds to a wide range of age and preparation. Also, I serve as an ombudsperson. In that role, I listen to students complain about classroom and other problems, and try to help them find solutions to their dilemmas.

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

From the institute, I hope to find guidance in asking the right questions to make the best use of comparative data generated between semesters of the same microbiology course, one taught on ground and one with lecture material delivered online. Like others, I want to be able to evaluate various teaching methods. Assessment of Student Learning Outcomes is a big issue on our campus.

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

Outside of the classroom, I enjoy (1) family activities (my late husband and I have five children between us, and seven wonderful grands), (2) competing in agility with my all American dog, Mocha (she's won lots of ribbons and she's even on YouTube), and (3) trying to figure out how to preserve MIDI music from a Roland U200 synthesizer so it can be played on newer and more reliable equipment, so we have music for choir on Sundays.

As for books, Susan Conant writes murder mysteries set in Cambridge, MA, where I lived after college; the one I'm reading now is called "The Wicked Flea." I'll be arriving in DC after leading a trek in New Mexico—Tony Hillerman country.

Assignment #2 Reflections

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

My research problem derives from many years of classroom teaching followed by a year of teaching online: How does online delivery of microbiology lecture information compare to traditional classroom delivery?

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

Randy Bass makes the distinction between Content knowledge and Method knowledge, a distinction that I think is important in microbiology. I'm curious to revise his questions as an opening day exercise for students—such an exercise may be diagnostic of where students are to begin with. That he compares and contrasts content analysis of student [written] work across semesters fits right in with my research problem, adding a dimension along with my plan to compare multiple

choice (and now that I've read his work, essay) questions. I'll need some help in framing a question with a measurable answer.

3) Which of the 12 properties of SoTL in microbiology education proposed by S. Benson's article are particularly relevant to your project at this stage?
Of Spencer Benson's 12 properties, I'd love to be able to say many of them, but clearly I'm not there yet. At this stage building on the work of other educators (P4) is relevant, and a comparison is problem centric (P8). Because my problem deals with online learning in microbiology, I believe it is relevant to other disciplines as well (P11). On a personal note, I'm excited enough to be among the scholars that my peers have definitely heard about the problem so far (P7).

4) Do you have any questions/concerns/comments that have evolved from your reading?
Craig Nelson owned up to the serendipity of meeting Jane Aiken as a Carnegie Scholar near the end of his article; the value of cross-disciplinary similarities is nonetheless valid. I like to think that nothing is wasted: Each of our experiences provides something from which to draw, even in another arena. Similarly, our students' experiences provide a background from which they learn. Our task is to find out how best to tap that resource and help them learn.

5) What do you see as tangible products to be developed as a result of your Scholars experience within the next 12 months?
As for product, I'd like to be far enough along with data analysis and writing to present results at ASMCUE 2009, and look toward publication in JMBE.

6) What do you see yourself presenting at the follow-up session at ASMCUE 2009?

7) What will you need to develop these products?

Assignment #3 Annotations

What I discovered from this exercise is that there's an enormous amount of information out there! It's a bit overwhelming to find the best and most appropriate resources to use. But it sure is fun to look. Current research is like an electronic version of what wandering through library stacks used to be. You never know what gems you will find.

1. Alisauskas, Rita. 2007. "The love triangle" forging links to students using digital technology to deliver content in microbiology classes. Focus on Microbiology Education 13(2):13-15. http://www.microbelibrary.org/asmonly/details.asp?id=2558.

Rita Alisauskas found that her online students earned higher grades on exams than did her traditional students (p. 13). She podcast her lectures, and made the online materials available to all students—both traditional and online. Her online students took more advantage of the material than did her traditional students, and scores of the online students were three to nine points higher than scores of the traditional students (p. 13).

This article got me to thinking about trying to compare the similarities and differences between online and traditional classroom delivery. I soon discovered that there's lots of information available!

2. Krawiec, Steven, Diane Salter, and Edwin Kay. 2005. A "hybrid" bacteriology course: the professor's design and expectations; the students' performance and assessment (ED490001). Journal of Microbiology & Biology Education 6:8-13. Available from http://www.microbelibrary.org/edzine/details.asp?id=2008. Accessed June 28, 2008.

Krawiec, Salter, and Kay taught a basic bacteriology course both in the traditional format and as a hybrid. The hybrid form consisted of lecture content delivered online, an emphasis on online resources, and three weekly "face-to-face conversations to advance understanding." No laboratory component was mentioned (for either format).

The authors compared the two courses over two years and did a statistical analysis of final examination results. Their data suggested no statistical difference in performance on the final examination. They also compared student evaluations, and found that students in the hybrid course "less strongly affirmed" than traditional students several measures: amount of work, positive interactions between student and instructor, learning a great deal, and recommending the course to another student. The evaluation protocol had 21 questions; on other measures, results were for the most part comparable.

The authors concluded that web-based instruction can have both advantages and limitations. The instructor matters, as evidenced by some of the less positive evaluations in the hybrid course, as compared to those from the traditional course. They suggested that clear directions on the one hand, and frequent feedback on the other might address the issues of dissatisfaction.
This paper provides a contradiction to Alisauskas and others, which may be useful.

3. Schoenfeld-Tacher, Regina, and Sherry McConnell. 2001-04-00. An examination of the outcomes of a distance-delivered science course (ED452069). Paper presented at the Annual Meeting of the American Educational Research Association (Seattle, WA, April 10-14, 2001).

The authors compared both the results and the interactions among students in an upper level histology course. The sample size was small (n = 44 students), but the course compared the same material delivered online and in the "traditional, on-campus format." Both groups took a pre-test (results were indistinguishable). The online students outperformed their on-campus peers.
Schoenfeld-Tacher and McConnell also investigated the interactions between in the course and among students and faculty, describing them as learner-content, learner-learner, and learner-instructor. In examining their exam questions, they applied Bloom's taxonomy.

They asked three questions: (1) concerning achievement between online and on campus students, (2) how does online delivery affect classroom interactions (in number and quality), and (3) how the instructor (or lack thereof) affects the number and type of questions in online group interactions.

I had not thought to use Bloom's taxonomy in looking at questions asked between sections of my comparable classes. But it's a good idea.

4. Leger, Daniel. 2008. PSYC 233 Aggression. Peer review of teaching project course portfolio. Available from: http://www.courseportfolio.org/peer/pages/index.jsp?what=portfolioObjectD&portfolioObjectId=283. [Accessed June 28, 2008.]

The author compared the exam performance of students in a traditional classroom and an online version of the same Psychology 233 (Aggression) class at the University of Nebraska, Lincoln, for the fall semester 2007 (classroom delivery) and spring semester 2008 (online delivery). His work is documented in an Inquiry Portfolio on the Peer Review of Teaching Project website. He found that online students did better than the traditional classroom students. He examined the study habits of his students in terms of when they logged in to the lectures. He found that online students who did well also paced themselves well. Most listened to one lecture a day, except perhaps for review. Those who did poorly procrastinated, and listened to several lectures right before the exams. Even online students cram for exams.

Leger makes the point that an online student can access a lecture several times whereas a classroom student has only one opportunity to see the "performance" of the instructor.

Leger's content (psychology) is a far cry from microbiology, but his comparison of access to content in a traditional classroom-delivered course and an online course speaks to my own experience in teaching both traditional and a hybrid class. In the traditional format, lectures are presented in advance of related laboratory exercises—access to content is controlled by the instructor. In an online class, however, students may not view the lectures before attending the related lab—access to content is controlled by the student. How that relates to student success in the class can be investigated.

5. Johnson, Mary T. 2008. Impact of online learning modules on medical student microbiology examination scores. Journal of Microbiology & Biology Education 9:25-29.

Johnson compared results from students at a large Midwestern medical school where students taught medical microbiology at nine regional campuses are given a common final exam. Her study included "71 learners from two different campuses who were taught by the same instructor and were admitted to medical school with similar exemplary credentials" (p. 25). Her hypothesis that students who prepared for the final exam using online learning modules—web-based quizzes—scored higher on the final exam than traditional students using paper-based review materials was supported.

Johnson has an extensive and useful bibliography (to be examined further). Her results also support two of the papers that I skimmed for this assignment (Dym 2002-2003, and Margulies and Ghent 2005). Although I have not (yet) looked at the time factor for my students, it is something to be considered.

Dym, Jeffrey. 2002-2003. The effectiveness of weekly online computer quizzes in helping students learn content. Poster presented as part of the Visible Knowledge

Project. Available from: http://cndls.georgetown.edu/applications/postertool/index.cfm?fuseaction=poster.display&posterID=237. [Accessed July 1, 2008.]

Results of one of the papers that I skimmed (Margulies and Ghent 2005) determined that for a medical microbiology class, students did better with 6-7 short exams than with three midterms and a final exam. Dym's paper reiterated the theme. Although this information may not be too useful in examining the difference between online and on ground content delivery, it is something I am considering for teaching in a future semester for my class. As such, its information I need.

Margulies, Barry J., and Cynthia A. Ghent. 2005. Alternative assessment strategy and its impact on student comprehension in an undergraduate microbiology course (ED49000). Microbiology Education 6:3-7.

Min-Ken Liao
Furman University, Greenville, SC

Assignment #1: Introductions

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

Greetings from Greenville, South Carolina where the sky is blue, water is clear and people drink sweet tea. I am an associate professor in the Biology Department at Furman University, a private liberal arts college. I teach Microbiology once a year, Genetics twice a year, and another course that can be Molecular Genetics, Human Genetics, Introductory Biology (major or non-major), or First Year Seminar. It is also expected that we engage students in research activities so I have a research group of 3-4 students.

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

There are several Biology Scholars projects I have in mind but the most important one is to design a teaching evaluation/learning assessment form to use for biology courses. The current Student Response Form that Furman uses does not tell me how effective I am in helping students learn.

Having "I LOOOOOOVE her" as my strength or "she hates me" as my weakness does not help me better myself. (By the way, the sentence also gives you a clue about my gender, in case minken is not easily identifiable.) Additionally, I believe that the questions asked on the evaluation form also send students messages about what good teaching/learning is like.

Therefore, students should be exposed to the form in the beginning of the class so they know what to pay attention to then provide more valuable information at the end of the class. I know there is no such a thing as a perfect form so I am aiming to develop a better one. And I am not an expert in assessing learning so I really don't know what I am talking about.

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

It is difficult for me to finish a book because I always have multiple books going on at the same time. When I am in my office, I feel like reading "twelve diseases that changed our world"; in my study, "the god of old"; in my bedroom, "the ghost map"; in the living room, a Chinese book about a historical figure (I am from Taiwan); and in the bathroom, "you might be a redneck if..." I just finished "Why we get sick" and a Chinese book on traditional Chinese medicine. I think I have reading ADD. Other than reading, the only "fun" thing I do daily is sitting in on classes. I have been at Furman for 8 years and I have sat in on 10 courses on campus so far. I plan to retire as a one-person liberal college.

Assignment #2: Reflections

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

My research problem that I would like to address is whether a course evaluation form can be used to engage students and to improve their learning by alter their attitudes toward a course. Too often a course evaluation form serves as a venue for

students to vent. Very little information can be extracted for future curricular/course designs. Such a course evaluation form also sends students a message that a successful learning experience depends solely on the teacher. It tends to place students and teachers in opposite positions while students and teachers should work side by side for meaningful learning to occur. My hypothesis is that if students' inputs about the content/activity/format of a course are specifically solicited in a course evaluation, they will be more likely to take the ownership of the course and give teachers more constructive suggestions that are useful for future course design. Meanwhile, the sense of ownership will lead to a more engaging, responsible learning attitude, which ultimately will enhance their learning. Furthermore, course objectives should be the backbone of this course evaluation form, and it should be stressed that both students and teachers are responsible for meeting the course objectives. Because of this, a course evaluation form should be presented to the students in the beginning of the course and their inputs be solicited in the end of the course.

Here is a set of example questions that I have in mind: (1) On which concept(s) should your instructor spend more time? How much longer, 30 minutes, 60minutes, or more? (2) There are a finite number of lecture hours in a semester. If one more lecture hour should be devoted to a particular challenging and important concept, then you are responsible for learning one hour of material on your own. What might that be?

Hopefully, presenting questions like these in the beginning of the course will help students develop a sense of ownership, prompt them to realize their responsibility in mastering the materials, and constantly evaluate their own learning. Their answers to these questions can also be as guides for future course design.

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

Therefore, Bass's story about his selection of and his student's reaction to Parkman's book resonates most strongly with my research problem. Students do not always understand why we do what we do. Tome, the recurring theme of the article is this gap between students and teachers. We don't know why certain students did better than others. We can't tell the difference between understanding and performing understanding. They don't know why we think certain concepts are important. Bass proposed the scheme of the inverted pyramid by identifying and focusing on the one ultimate goal of his course. And I believe that he should not do so alone. Students are equally responsible for the goal. As I often tell my students, "You got it doesn't mean you have it. You still need to work on it."

3) Which of the 12 properties of SoTL in microbiology education proposed by S. Benson's article are particularly relevant to your project at this stage?

Of Benson's 12 properties of SoTL in microbiology education, I found #1 (reflective analysis), #5 (to be built upon), #8 (problem centric) and #10 (engagement in teaching) are most relevant to my project, and #6 (stimulating intellectual exchange) is my ultimate goal.

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

5) What do you see as tangible products to be developed as a result of your Scholars experience within the next 12 months?
I hope that within the next 12 months I can design and "test-drive" a course evaluation form (with proper controls) and develop a convincing and effective way to assess student's responses.

6) What do you see yourself presenting at the follow-up session at ASMCUE 2009?
And I have to present at ASMCUE 2009because that was what I promised in my grant proposal. I, too, look forward to a publication in JMBE.

7) What will you need to develop these products?

Assignment #3: Annotations

I guess it is a good sign that the more papers I read, the more focused my research project gets. My project is to encourage students to reflect upon what they have learned on a weekly, if not daily, basis and identify which topic(s) needs more lecture time and which topic(s) they can learn on their own. My hypothesis is that reflecting course content in such a way will encourage students to assume responsibility for their own learning. Ultimately, I hope it will make students realize that, in addition to the teachers; they are also responsible for the success of their learning experience and consequently become self-motivated learners. I am in the process of fine-tuning my experimental designs and am seeking applicable semi-real-time classroom self-assessment methods for students and end-of-the-course evaluation methods for this approach in literatures. I could not find papers addressing and reporting similar research questions but I found many that are helpful. After having read the papers/handbook listed below and more (which I am not thrilled about because I am swamped by four first-time student researchers and two week-long conferences), I am grateful that I was "forced" to make significant progress in my research project.

1. Belzer, S., Miller, M., & Shoemake, S. (2003) Concepts in Biology: A supplemental Study Skills Course Designed to Improve Introductory Students' Skill for Learning Biology. *The American Biology Teacher 65*(1):30-40, 2003

The authors seek to convince readers that to help students succeed in biology courses of introductory level it is necessary to improve their study skills. The authors first identify and describe a "high risk" course (course with a higher failure rate) in their institute and further indentify possible reasons for failure. Targeting one of the possible reasons - a lack of self-discipline and study skills, the authors offer students the one-hour per week Concepts in Biology course which focuses on teaching study skill and biological thought processes. They hypothesize that students taking the Concepts while taking the high risk course will improve their content knowledge and motivation significantly (demonstrated by lower failure rates) and will also perform better than students who do not (demonstrated by comparing two student groups.) Additionally, they investigate whether the Concepts course impacts female students more significantly and whether students' performance in their pre-course content knowledge tests is a good indicator for their final grades. The authors conclude that the Concepts course significantly increases in student motivation and success rate in the high risk course. The relationship between student's pre-course content knowledge test scores and the final grade is weak.

Female and male students are different significantly on content and motivation measures. While the experimental designs are tight and analyses are valid, the paper loses its focus when reporting whether the pre-course content knowledge test is a good indicator for student's overall course performance and whether the Concepts course impacts female students more significantly, as these are not their objectives of developing and offering this course. Additionally, one can easily argue that although students who took the Concepts course did not perform significantly better than students who did not take the course in the pre-course content knowledge tests, they were more conscientious about their learning experience in biology, as demonstrated by voluntarily taking the course, and would naturally work harder. Nevertheless, numerous skills taught in the Concepts course are stimulating and have helped me tweak my experimental designs.

2. Brewer, C. A. (2004) Near Real-Time Assessment of Student Learning and Understanding in Biology Courses. *BioScience 54*(11):1034-1039

The author presents two instructional technology tools that prompt students to reflect on their learning constantly and allow faculty to assess student's learning simultaneously. The tools are (1) off-the-shelf personal response systems (PRS) for in-class assessment, and (2) a custom-designed Web-based assessment for use between lectures (BioBytes). These tools are also designed to encourage more faculty to use computer-aided instruction. The PRS functions similarly to the classroom Clickers system in that students' answers to a question are tallied real-time. This in-class assessment tool allows teachers to address any confusions or misconceptions instantaneously. The BioBytes is basically online quiz system. Students take the quiz by providing the answers as well as their confidence level in each answer. What makes this paper stand out in my blurry memory of research papers I have read since the beginning of the summer is that the author asks students to report the confidence level in their answers. Confidence level can be used to indicate how well students think they understand the materials, which allows instructors to make adjustment in teaching accordingly. Therefore, I plan to survey student's confidence level in my research.

3. Dancy, M. H., & Beichner, R. J. (2002) But Are they Learning? Getting started in Classroom Evaluation. *Cell Biology Education 1*:87-94

The paper consists of three major points. (1) The authors first argue that in addition to traditional classroom feedback, formal educational research is necessary in order to effectively help students learn. (2) The authors also assert that, though usually not formally trained in doing educational research, biologists are more ideal than education experts in designing and conducting educational research in biology. (3) The authors point out that the methods of and supports for education research are readily available. They demonstrate so by providing information about the resources of education research and describing/distinguishing quantitative and qualitative research in great details. Additionally, the authors report their physics education research project as an example, because both quantitative and qualitative investigations are implemented in this project. However, the results of the research project are not included in the paper, which makes the example not as illustrative and helpful as it would have been otherwise. The paper is of great value to my research project because it provides resources where more databases, methods, listservs and literatures can be found.

4. Leahy, S., Lyon, C., Thompson, M., & William, D. (2005) Classroom Assessment: Minute by Minute, Day by Day. *Educational Leadership 63*(3):18-24

This paper is written for teachers of K-12; however, this is the most practical paper I have read. The authors first point out the difference between assessment of learning and assessment for learning. Assessment of learning is an end-point evaluation of student's performance/learning, while assessment for learning is a real-time process of teacher-student interactions. The authors identify a set of five broad strategies relevant for teachers who are interested in assessment for learning: (1) Clarifying and sharing learning intentions and criteria for success, (2) Engineering effective classroom discussions, questions, and learning tasks, (3) Providing feedback that moves learners forward, (4) Activating students as the owners of their own learning, and (5) Activating students as instructional resources for one another. The authors also provide practical examples in each strategy for implementation. Compared to other "heavy-duty" educational research papers (which I've read and forgotten), this paper is relatively light. However, its emphasis on assessment for learning has made a strong impression on me and challenges me to think longer and harder about assessment.

5. National Science Foundation (1997) User-Friendly Handbook for Mixed Method Evaluation. URL: http://www.nsf.gov/pubs/1997/nsf97153/start.htm. Accessed July 1, 2008

When conducting educational research, it is preferable to incorporate both quantitative and qualitative investigations (mixed method design) in order to strengthen the validity of results and gain more complete insights. Most biologists are more familiar with quantitative methods and more capable in analyzing quantitative results. However, the same cannot be concluded with qualitative methods as qualitative data are more difficult and time consuming to analyze. Thus the National Science Foundation has developed a detailed user-friendly handbook for those who are interested in qualitative research. The 124-page handbook gives an overview of qualitative methods and analytic techniques as well as designing and reporting mixed method evaluations. I have not yet finished the handbook but have already identified useful sample forms and examples in the handbook.

Mangala Tawde
Queensborough Community College, Bayside, NY

Assignment #1: Introductions

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

I am an Assistant Professor at Queensborough Community College (QCC) at Bayside, NY which is one of many CUNY (City University of New York) colleges. Being a city college in Queens, at QCC, we are benefited by having a highly diverse student population. At QCC, not only we focus on undergraduate education, but also student participation in faculty mentored research projects.

Though I am currently teaching pre-nursing courses such as Human Anatomy and Physiology-I and II and Microbiology, I have also been teaching general biology to majors and non-major students. I was a full time research scientist till I started teaching full time only about 3 years ago when I realized that I really loved teaching.

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

Since I am still in the beginning phase of my teaching career, I think I have a lot to take home from the SoTL institute, besides various teaching techniques. Since our student population is so diverse, I keep changing my strategies to suit needs of many of them. With the help from SoTL, I would like to build an online resource center/course which the non-majors or the pre-nursing students can use to better-prepare them for their respective courses. I believe that team-based learning is an effective technique but would like to know various aspects of these pedagogical techniques.

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

Outside of classroom, I too, enjoy being outdoors, working in our yard and garden, playing with my young daughter, watching movies and going to the beach with my family.

Assignment #2 Reflections

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

My research Question is whether an online biology class can enhance the basic scientific understanding and skills of Biology students. I propose to develop a virtual biology classroom with some virtual laboratory components to complement and update the basic biological exercises. The focus of my virtual Biology Class will be on developing students' understanding of basic biology concepts.

I propose to examine various approaches and tools used in Biology Education. In the virtual classroom, the students will be presented with basic concepts of Biology, Biochemistry, cell biology and/or genetics. The concepts presented will include (but may not be limited to)-- 1) What is Science and Biology; 2) Cell theory; 3) Prokaryotes and Eukaryotes; 4) Elements and chemical reaction; 5) chemical

interactions between biomolecules; 6) Cell structure -cell membrane and organelles 7) homeostatic processes.

2) What theme(s) based on your readings, resonate with your "problem" and/or your proposed approach to address your problem?
To this end the assigned readings helped me to define/isolate many "Problems" that I had in my head actually in the form of many "Questions". As Bass said however we try to avoid having a "problem in teaching" and I found solace in knowing that it's OK to have these "problems" in teaching and realized that I will continue to have them for the rest of my career. I also think I can very well relate to Bass's inverted pyramid as I often reflect at the end of a semester and ask myself if I did indeed spend adequate time on the goals I value most. Unfortunately I'm not always satisfied with the answer.

3) Which of the 12 properties of SoTL in microbiology education proposed by S. Benson's article are particularly relevant to your project at this stage?
Twelve properties of teaching and learning described by Benson made me reflect not only on my pedagogy practice but also to see the similarities in scholarship of teaching and discovery. Though I could relate to all, the first five form essential aspects of teaching in all disciplines. However I find that for the specific research problem I am interested in, most relevant to me would be reflective analysis (1), documentation and dissemination (2), previous work (4), others can build upon (5), exchange of information (6), engagement (10), and interdisciplinary (11). I strive to follow many of these properties in my teaching however I realize that this is going to be an ongoing process for improvement and creativity. I also agree with successful SoTL, it is critical that good (not necessarily best) teaching ideas need to be published so that all --not only novices like me but students-faculties would be benefited alike.

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

5) What do you see as tangible products to be developed as a result of your Scholars experience within the next 12 months?
As I am getting ready to immerse myself in the year-long SoTL starting in July I hope to get more insight and ideas about how I design my "experiment" (online Biology class) to answer my research question. I am also open to the idea that I could modify my question or ask it in a different way to ensure better student understanding.

6) What do you see yourself presenting at the follow-up session at ASMCUE 2009?
And most likely though I may not have complete data sets of my experimental results; I am hoping that I would get enough student success /assessment data to either support or negate the hypothesis which I will be able to present at the follow-up session at ASMCUE 2009.

7) What will you need to develop these products?
For this I think I need to identify good tools to compare the assessment data sets and some help/insight from more experienced colleagues.

Assignment #3 Annotations

Based on my research question, I was curious to find about the research on how online/web-based instruction influences undergraduate science (Biology) teaching-learning experience. We all are the products of generation who almost strictly learnt science by hands-on exercises. However today's of students seems to be more inclined to/interested in as much use of digital technology in instruction as possible.

1. Steven Cunningham, Steven, McNear, Brad, Pearlman, Rebecca and Scott Kern (2006) Beverage-Agarose Gel Electrophoresis: An Inquiry-based Laboratory Exercise with Virtual Adaptation. CBE- Life Sciences Education. Vol. 5, 281–286, Fall 2006

I found this article very interesting because Kern et al not only developed this fun technique of BAGE to promote inquiry-based learning, but they developed the whole exercise of optimization of BAGE into an online exercise. They further evaluated the effectiveness of we adapted this laboratory process of progressive optimization to a Web-based format in which students had to achieve all the same steps of optimization by performing serial electrophoreses. And third, we evaluated the use of this entirely Web-based virtual laboratory exercise in high school and undergraduate biology courses. Students learned fundamental and practical principles of electrophoresis, while experiencing the essential inquiry-based process of optimizing a technique, and they also enjoyed it. Our findings provide a readily accessible, inexpensive, and intriguing technique for teaching electrophoresis and the progressive optimization of a laboratory technique. Limitations, advantages and disadvantages of the

2. Michaels, John, Allred Kelly, Bruns Christina, Lim, Wan, Lowrie, Jr, and Wade Hedgren. (2005). Virtual Laboratory Manual for Microscopic Anatomy. The Anatomical Record (Part B: New Anat.) 284B:17–21.

Here the authors assembled a virtual laboratory manual; they call it VLM, which is a Web-based copy of a traditional laboratory manual, using digital technology –high-resolution cameras and expanded memory computers. The VLM is used to enhance traditional laboratory instruction in histology. For each reference in the VLM to either a histological slide or an electron micrograph, they included a hyperlink that would download digital images derived from the students' glass slide sets or scanned electron micrographs. The VLM serves as an atlas of digital images for concurrent study of similar sections by light microscopy during laboratory sessions which can be accessed remotely as well. This resource is a supplemental resource as use of light microscopes is continued in laboratories by basing the majority of practical examination identifications on analysis of marked histological slides that require students to use their own microscopes. The VLM provides the convenience of a supplemental Web-based resource with high-quality images, yet allows retention of the many excellent traditional aspects of course.

This article was a BIG answer to one of my major query I was looking for as this is almost exact same resource I would like to develop at QCC. Actually I have already discussed the possibility of developing a similar resource in our department for the study of Histology in the Human Anatomy-Physiology course as well as studying various microorganisms by light microscope in Microbiology class. The authors analyzed students' evaluation of the course to assess the benefits of VLM and found small increase in favorable evaluation as well as their grades, but otherwise the article doesn't discuss any downside or other limitations of the study in their article. However, I am personally confident that as long as the digital/virtual microscopy lab

doesn't replace traditional lab, having it as an additional supplementary resource would be always beneficial.

3. Lundin, M, Lundin, J, Helin, H, and J Isola. (2004). A digital atlas of breast histo-pathology: an application of web based virtual microscopy J Clin Pathol; 57: 1288–1291.

This study was very similar to one described in the article #2, the only difference is its one step ahead of the previous. The authors developed an atlas of breast histopathology. By using a robotic microscope and software adopted and modified from the aerial and satellite imaging industry, a virtual microscopy system was developed that allows fully automated slide scanning and image distribution via the internet. Slides scanned at high resolution were archived on an image server. A publicly available website was constructed featuring a comprehensive virtual slide atlas. Users can view any part of an entire specimen at any magnification within a standard web browser. The virtual slides are supplemented with and without textual descriptions, for self assessment of the histopathology skills.

4. Maged N Kamel Boulos, Inocencio Maramba and Steve Wheeler. (2006) Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education. BMC Medical Education 2006, 6:41

This "Debate" paper was first-hand information for me which explained exactly what these new tools (or toys) really are. The authors have explored how these Web 2.0 applications would prove useful on the long run for virtual collaborative clinical practice and learning, based on the currently available initial online medical/health-related examples and literature about these tools. Along with introducing the power of these web-based tools in education, the article calls for need for research to be conducted to determine the best ways to integrate these tools into existing e-Learning programs for students, health professionals and patients, taking into account the different needs of these different audience classes. The article informs about the exploding examples of use of these tools in m-learning (mobile-learning) in health and medical education.

5. Selective use of the primary literature transforms the classroom into a virtual laboratory. (2007). Hoskins, Sally, Stevens Leslie and Ross Nehm. Genetics Education: Innovations in Teaching and Learning Genetics. Edited by Patricia J. Pukkila.

This article is different from the previous articles I describe above. The authors describe a new pedagogical technique - CREATE (consider, read, elucidate hypotheses, analyze and interpret the data, and think of the next experiment) as a new method for teaching science and the nature of science through primary literature. CREATE uses a unique combination of novel pedagogical tools to guide undergraduates through analysis of journal articles, highlighting the evolution of scientific ideas by focusing on a module of four articles from the same laboratory. Students become fluent in the universal language of data analysis as they decipher the figures, interpret the findings, and propose and defend further experiments to test their own hypotheses about the system under study. At the end of the course students gain insight into the individual experiences of article authors by reading authors' responses to an e-mail questionnaire generated by CREATE students.

Assessment data indicated that CREATE students gain in ability to read and critically analyze scientific data, as well as in their understanding of, and interest in, research and researchers. Authors claim that the CREATE approach demystifies the process of reading a scientific article and at the same time humanizes scientists. The positive responses of students to this method are provided at length in the article.

Though this reading assignment took me much longer than I initially thought I was surprised and overwhelmed by the realization that there is so much information out there!
It definitely helped me to define my research project further and made me think harder but at the same time I find this experience highly exciting.