

**The Portfolio Project:
Helping students take more responsibility
for their learning**

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Olin College

4 year degree programs (first graduating class 2006)

3 undergraduate degrees Mech E, ECE, E (BioE, E, Self-Design)

~ 350 students, 40-45% women

~98% graduation rate

Student centered culture

Project-based learning emphasis

SCI1210 Principles of Modern Biology

Introductory Biology Course

Required for all students

Usually taken before end of 3rd year

Class size 15-25 students

1 semester, 4 credits, includes laboratory section

3 Professors, 1 Laboratory Instructor



**PRINCIPLES OF MODERN BIOLOGY
WITH LABORATORY**



SCI1210-2, FALL 2011

Portfolio Project

3 year experiment continuing

Portfolio Design Considerations and Pedagogical Goals

Major Objectives are Self-Assessment and Reflection:

By Students on their Learning

With Respect to Course Measurable Outcomes and Competencies

Individual Assignments and Entire Semester's Work and Outcomes

Portfolio Design Considerations and Pedagogical Goals

Impact on Course Grade

Viewed as a Positive Activity by Students

Students Take More Responsibility for Learning

7 Required Portfolio Entries

1. Portfolio entries for 3 of 4 quizzes (include the 4th without entry)
2. One In-Class problem “team” set, one Homework assignment, “Science in the News” discussion that you led, or “Class Opener”
3. An additional entry of your choice
4. Your PTC laboratory report
5. Final course assessment and reflection
6. Your Teaching/Learning Module (optional)

8 Measurable Outcomes

1. Students have an understanding and ability to communicate effectively, by written and oral means, knowledge of the major principles of modern biology.
2. Students are able to demonstrate their understanding of the major principles of modern biology by applying their knowledge to solving quiz and homework problems, including some that require interpretation of primary data from experiments.
3. Students are able to produce a coherent laboratory notebook and demonstrate an ability to understand the design and be able to conduct and evaluate the results of a set of experiments.
4. Students are able to summarize and explain the results of their laboratory experiments in writing that demonstrates critical thinking and that is clear, professional, and that employs good language mechanics.

8 Measurable Outcomes

5. Students have an appreciation of biology as an observational and experimental science and an understanding of the meaning and importance of the scientific method.
6. Students develop adequate scientific literacy to interpret biological findings reported by the press and are able to research these and other relevant biological issues using primary and secondary scientific literature source material.
7. Students have an understanding and appreciation of the social and ethical implications of the use of scientific findings in the world at large.
8. Students have developed an accurate and insightful self-appraisal of themselves as learners.

Competencies Developed and Assessed

1. Communication
2. Diagnosis
3. Context
4. Qualitative reasoning
5. Life-long learning

Portfolio Rubric

Grade	Description
A	Entries provide an in-depth understanding of the content of the assignment and recognition of strengths and weaknesses of the initial response to the assignment. Evidence for growth of learning by analysis of shortcomings and identification of areas of accomplishment. Thoughtful and personal response to the material being covered and level of learning achieved. Evidence of significant progress with regard to the measurable outcomes for the class are clearly presented and further reflections on achievement is included. Entries demonstrate a high level of professionalism in writing and neatness.
B	Entries represent a basic level of understanding of the content of the assignments. Basic requirements of the assignment are met. Evidence of achievement of the measurable outcomes is clearly presented. Entries are acceptably neat and professional in writing style. Submissions contain responses to material being covered and level of learning achieved. Non-specified entries are relevant to SCI1210.
C	Entries may appear to be hastily put together and fail to meet the basic requirements of the Portfolio. Reflections are vague, too general or missing for one or more of the required entries. Measureable outcomes are not addressed adequately. Little self-awareness is demonstrated in evaluating learning or assessing strengths and weaknesses in responses to assignments Portfolio entries are not well organized and sloppy.
D or F	Extremely low quality of work for the entries. Little attention to guidelines and low level of effort overall. No perceptible self-awareness of learning deficiencies or progress in the course measurable outcomes.

Example Student Entries

Student A

Portfolio Entry --- Quiz #4

Similarly to Quiz #3, I tried a new strategy for studying. Before, I had largely relied on my own individual notes and a few brief group study sessions. However, on this quiz, a group of us decided to try a much more collaborative approach, where each would study a particular chapter or section in detail and then present it to the rest of the group. In this way, I think we had a much deeper understanding of a few sections and covered all of the topics in a more efficient way. I do not know how well the group performed, but I think that this studying method worked very well for me and I wish that I had used it in earlier quizzes, as it both cut down on the total time spent and increased my knowledge. This, along with Quiz #3, gave me a few opportunities to improve areas of my studying habits that have needed attention for a long time (Competency #5).

Student A

My response to *I-C* is a classic example of not taking the necessary time to fully read and understand a question. I looked through the list of options and saw that many were correct, though (4) seemed suspicious. However, my stress to finish the quiz on time urged me to press on, and I simply circled “all of the above.” Had I bothered to read the question in full, I would have seen that I could have circled more than one answer and avoided the incorrect option (4).

Question 3 revealed my lack of knowledge on the lac operon. I was fully aware that this would be emphasized on the quiz, but I did not allocate enough time to studying it. As a result, I missed details on the role of CRP and completely misunderstood the distinction between positive and negative regulation. These should have been easy points since they were effectively guaranteed to be on the quiz.

Student A

I am satisfied with how this quiz went overall. The experimental procedure section and the long essay question in particular were important assessments of not just my rote knowledge, but also my ability to synthesize and analyze a fully detailed and realistic problem in biology (Measurable Outcomes 5 and 4, and Competencies 1, 2, and 4). As in the previous quizzes, this reflection improved my *self-appraisal, effective communication skills, and my understanding of major principles of modern biology* (Measurable Outcomes 8, 1, and 2, respectively).

Student A

Portfolio Entry --- Contagion

For the additional entry to my portfolio, I chose to watch *Contagion*, a film exploring the consequences of a highly contagious and lethal virus that has spread across the globe. While the intended audience is not scientific, the film covers rudimentary aspects of immunology and epidemiology, as well as a thorough investigation of the ethics of distributing treatment in a panic-stricken world. Compared to many movies that use a “scientific crisis” to drive the plot, I found *Contagion* to be refreshingly accurate and realistic (though, of course, this is a relative term).

Overall, I enjoyed the movie, and I think it contributed to my *appreciation of the social and ethical implications of the use of scientific findings in the world at large* (Measurable Outcome 7), in addition to my *understanding of the meaning and importance of the scientific method* (Measurable Outcome 5). I also find that it assessed my competency to place biological concepts within appropriate *contexts* in the non-scientific world (Competency 3).

presented in the movie, a lottery based on birthdays, seems fair and equitable, but I doubt its practical efficacy. Those with power and the resources it entails will almost always find the means to receive earlier treatment. The idea that millions will sit contentedly while others receive the vaccine seems wildly naive. I would expect the masses to resist and incite more fear and conflict than was shown in the movie. Jude Law's character exploited this wide-spread fear for personal profit, and yet, millions trusted his online endorsement of homeopathic forsythia. His character represented the all-too-human tendency to misplace our trust amidst a collapsing society.

Student A

3) Students are able to produce a coherent laboratory notebook and demonstrate an ability to understand the design and be able to conduct and evaluate the results of a set of experiments.

I found that keeping up a coherent laboratory notebook was surprisingly difficult. After the first assessment of my notebook, I think that I significantly improved my methods and wrote down more important aspects. (Before, I had devoted a lot of time to unnecessarily copying segments of the procedure that was available online). The formal technical reports, though, were the most helpful in learning to evaluate the results of my experiments.

Student A

8) Students have developed an accurate and insightful self-appraisal of themselves as learners.

This portfolio is the most direct method through which I improved in this outcome, since it gave me the opportunity to reflect on which studying and learning strategies worked best for me. This was especially

evident when I compared my reflections on quizzes 1, 2 and 3. My studying strategy definitely improved over time, as I spread out my work, avoided late-night cram sessions, and effectively used study groups.

Student A

C. Additional Comments

I really enjoyed this class! It has significantly kindled my interest in the subject (which had been lacking since freshmen biology in high school). The use of historical experiments and the outside lecturers were my favorite aspects and, in my opinion, contributed the most to my learning.

Student B

Quiz 1 Reflection

(Corrections and reflections on individual questions follow this general reflection)

I thought this quiz was a complete train wreck for me. On most questions that I answered incorrectly, I was wrong for 1 of 3 reasons- either a definition/fact that I couldn't recall, a misunderstanding of what the question was asking, or a simple lack of time. On some questions, a combination of these factors came into play.

Student B

I tended to skip the questions that required more thought than simple recollection, because I was worried if I stopped to think, I wouldn't have enough time to finish the quiz. Some of these questions I later went back to, but others I did not. Question 2 is an example of one that I would have been better off skipping- I spent a significant amount of time trying to figure out structures that worked for each definition, and ended up not getting most of them. The idea of connecting the 3 carbons into a chain did not occur to me, even though I know that's extremely common in organic molecules. I now realize that if I'd had a better understanding of some of the major principles of biology (outcome #2), these questions would have been easier for me.

Student B

One of the lessons I got out of the test was the importance of studying. Because I took detailed notes while I was doing the readings (~7 pages/chapter), I assumed that I'd learned everything while doing the readings. So, my studying consisted entirely of looking at the notes on hemoglobin/PrP, and briefly glancing at the worksheets and notes from class. I didn't study the chapters in any detail. I also assumed that because it was a quiz (and not a test), it would be neither long nor detailed.

Student B

Final Reflection

Students have an understanding and ability to communicate effectively, by written and oral means, knowledge of the major principles of modern biology.

I felt like my understanding of biology increased over the semester. I came in feeling like I knew biology, because I'd taken honors biology and AP biology in high school, but this class made me realize how little I actually remembered- and helped me to fill in those huge gaps in knowledge. I felt that on tests, I was able to demonstrate my knowledge- for example, the immunology essay at the end of the semester, and the homework essay about hypotheses, theories and facts.

Student B

Students have an appreciation of biology as an observational and experimental science, and an understanding of the meaning and importance of the scientific method.

The famous experiments we learned about in class definitely gave me an understanding of the meaning and importance of the scientific method. For example, learning about Hershey and Chase's experiment (which prove that DNA is the genetic material), and the documentary about Rosalind Franklin (who played a crucial role in discovering the double-helix structure of DNA), helped me to understand the importance of the scientific method. Furthermore, the experiments we did in class gave me an appreciation of biology as an observational and experimental science. I realized that biologists have to pay meticulous attention to detail, and that even 1 microliter can be the difference between success and failure.

Student B

Students have developed an accurate and insightful self-appraisal of themselves as learners.

Working on these reflections helped me to develop an accurate and insightful appraisal of myself. Furthermore, this helped me to improve my performance over the course the semester, as I was able to better recognize study strategies which work for me.

Student B

Life-long learning

To be honest, I'm not sure how "life-long learning" can be assessed. It seems like something that requires literacy, curiosity and access to information. Given that I possess all 3 of these qualifications, I think that I am highly adept at life-long learning. Given my love for reading, and the fact that I check the NYTimes website every day, I will likely continue to read about biology on my own time, as it appears in popular media. I'll definitely stay intrigued by the ethical implications of research, particularly as things like DNA sequencing and biological warfare become more pertinent to day-to-day life.

Student C

Quiz 1 Reflection and Self-Assessment

I am disappointed with my grade on this quiz, and feel that it does not accurately represent my knowledge of the material.

I lost only one point on the entire first section of this quiz, which dealt with key concepts like organic chemical structure, the properties of water, the structure of DNA, the role of lipids in organisms, and the details of the different monomer units.

My test completely fell apart in the second half. For the lab question (#6), I correctly calculated the amounts of the stock solution to add, but couldn't think of a specific reason that the experiment wouldn't work. Obviously the additional heat did something to the reaction to make it not work, but I couldn't pick out specifically which component would be affected, especially since my chemistry background tells me that reactions are *more* likely to take place at higher temperatures. In the end I hedged my bets and wrote an answer that was too vague.

Student C

I completely trashed the hemoglobin question. Going into the question, I had a cursory understanding of how the process worked, but the extent of my knowledge was actually given as part of the question. For example, one of the things we were specifically told to know was that in fetal hemoglobin there is a substitution of serine for His143. That's what I expected an answer to be, but instead that was part the *question*.

Basically, I have no excuse for not doing better on this quiz. I understood the fundamental concepts but completely messed up the extra stuff. I only lost significant points on the lab question, where I choked, and the experiment and hemoglobin, where a bit more studying of those specific concepts would have turned my 80 into a 94.

Student C

Reflection on the Course

I am satisfied with my level of learning as a result of this course.

Measureable Outcomes

1. From our discussions in class and the written homework assignments, I feel that I am able to effectively communicate through written and oral means the major principles of modern biology.
2. I understand the major principles of modern biology from the quiz and homework problems. I think the quizzes would have been better if they were less about memorizing facts and definitions and more about our conceptual understanding of the material.
3. I've learned how to keep a good lab notebook from this class.
4. From the lab reports and notebook, I've learned out to summarize and explain the results of our experiments.
5. I enjoyed the wide range of guest speakers, so I've gained a greater appreciation of biology as a subject.
6. From our discussions in class about current topics in biology, I feel like I know enough to research primary and secondary scientific literature source material.
7. I enjoyed the ethical discussions we had in class, and from that I have a greater appreciation of the impact new discoveries in biology have on the world.
8. I know more about myself and how I learn from this class.

Student C

I ended up doing only OK in the course. (I think I'll end up with around a B). One thing that might help in the future is stratifying the classes based on their prior Bio experience. Unlike a lot of my classmates I didn't have AP Bio in high school. The only Bio I had was a high school freshmen level class that didn't go nearly into the depth that our class did here.

Also, full disclosure, I've never really enjoyed Biology as a subject. The subject matter itself is interesting, but the way Bio is taught never really clicked with me. I learn best by figuring things out until they make sense, so subjects like Physics, Math, and Computer Science come naturally to me while Bio does not.

A cool thing that might be worth trying is having the two sections of Bio focus on different things. One section could teach Bio in the traditional way like this class, while another ("Bio for non-BioE's") could touch on cool Bio related ideas and how they can be applied to other disciplines of engineering. I would remember a lot more from that class than I will from this one.

Student C

Grade and Comments from HDK: Grade = C. I expected to see improvement from the draft portfolio but the reverse occurred. The requirement of dividers was ignored and, more importantly, there was scant or no attention paid to measurable outcomes and competencies. This is particularly surprising since it was clearly stated as a deficit in the draft portfolio grade sheet. The work on the special project was well done but that is the only shining star in a very dark night for your learning in biology. The self-assessments demonstrate an awareness of what went wrong with your learning but there is no apparent self-awareness on what could be done to obtain an educational benefit from the course. I appreciate your recommendation for a class that segregates the bioE majors from the non-bioE students but for a variety of very good reasons that is not a good idea. I would be pleased to discuss why the idea has not worked in the past with you.

Lessons Learned

Not every student recognizes the benefit of frank self-assessment and reflection

Lessons Learned

Be reasonable about number and type of entries

Make draft portfolio entry due/graded early in semester

Provide example good and bad portfolio entries

Make the portfolio matter with respect to overall grade

Portfolios help distinguish grade borderline cases

Portfolios provide instructor with insight about student learning

Recommendation

If the portfolio project is not feasible for your teaching.....

Try one portfolio entry assignment
(corrections, self-assessment and reflection)

