Millikin University
Student Learning in Biology FY2006-2007

By
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microbiologist, one ecologist, one anatomist, two physiologists (one is teaching half-time), a

data personally collected or analyzed by the student. The following rubric has been used to evaluate how well the student used logic and critical thinking in their work.

	Excellent (5 points)	Adequate (3-4 pts)	Nominal (1-2 pts)
Format	Paper in proper scientific form, with all standard categories Tables and figures correctly constructed with good legends Standard use of grammar and spelling. Fewer than one error per two pages Logical organization Literature appropriately used and cited	Section(s) missing, or some material in wrong section Same data presented more than once, or inappropriate figures used Some grammar errors and spelling errors (Fewer than one per page) Some literature used, but inadequate or improperly cited	Non-scientific form Data not presented, or raw data presented One or more grammatical and spelling errors per page. Poorly organized Little or no literature used

ORAL PRESENTATION	
Content	
5	Emphasis on student testable, novel hypothesis that would extend research in the field.
	All required components included (Abstract, Introduction, Methods and Materials, Results, Discussion, Acknowledgements, Literature Cited) with correct and necessary information included in each section.

The average improvement scores for objective 1, and evaluation of syllabi for direct ties to evolutionary concepts

List of classes taken and grades for objective 2.

Three papers, one from the freshman year, one from a research project the student designed, and the senior seminar capstone paper, will be collected and evaluated using the rubric for objective 3 by the senior seminar instructor.

Evaluation scores for objective 4

We have not fully settled on the plan of action on our assessments in Goal 3. We are considering the following possibilities:

Evaluate all three papers collected using the same rubric ï the instructor responsible for the senior seminar grade will do the evaluation for students during the senior seminar semester.

Transfer students without three papers to evaluate will be excluded from the analysis.

Until fall of 2008, we will not have freshman papers to compare to senior papers, Therefore, only papers from senior seminar will be evaluated to assess Goal #3 until fall of 2008.

Another issue, which we have not adequately addressed, is the issue of consequences for individual failure to meet the expected objectives. Obviously if the problem is wide- spread, it requires adjustments in the department teaching and curriculum. Individually, however, we need to formulate how students would be remediated in order to bring them up to the level expected by our objectives. There is a need for early feedback to allow time for remediation. Before we began developing firm criteria for performance, no student had failed senior seminar. Since we began developing the rubrics in the Fall of 2005, we have encouraged three students to drop senior seminar and retake it when they were more prepared, two students to redo analysis and posters and present later in the semester, and two students have failed. We are working to ensure that all students have the tools needed to succeed in meeting the goals of the biology department.

ANALYSIS OF ASSESSMENT RESULTS

GREEN LIGHT ï

At the introductory level, testing indicates that we are approaching a high level of success. Goal #1 will be judged successful if we are able to demonstrate a 25% improvement between the pre-test and the post-test scores during the freshman year and a maintenance of this through the senior year. Over 90% of syllabi should show direct relationship of evolutionary concepts.

Goal #2 ï All students complete a course in each content area, all grades for the six courses elected by all graduating students are C- or better, and less than 10% must repeat courses to achieve this goal.

Goal #3 ï Three papers are placed in the studentôs portfolio, there is an average of 10% improvement from freshman to junior and from junior to senior, and the average review score for seniors is 10 or better.

Goal #4 ï At the completion of Senior Seminar capstones, the oral presentation scores average 20 or better and poster evaluation scores average 16 or better.

YELLOW LIGHT ï

Goal #1 ï Definite improvement between pre and posttests but less than 25 %. Seventy five percent of syllabi for majors courses show direct relationship to evolutionary concepts.

Goal #2 ï Some students are not completing one or more of the content areas, or more than 10% must repeat courses to achieve a C- or better in each.

Goal #3 - Three papers have been placed in the students portfolio, with less than 10% improvement. Average evaluation score for the senior paper is 9.
Goal #4 ï Average evaluation score for the oral presentation is between 18 and 20, and the poster score between 14 and 16.

RED LIGHT ï

Goal #1 - Little or no improvement between pre and post-tests, or little retention of concepts. Less than 75% of syllabi for majors courses show direct relationship of evolutionary concepts.
Goal #2 ï More than 10% of students do not complete one or more of content areas, or more than 15% must repeat courses to achieve C- or better.
Goal #3 - Fewer than 3 papers in the folio, with an average evaluation score of less than 9.
Goal #4 - Average oral presentation score for seniors is below 18 and average poster score is less than 14.

IMPROVEMENT PLANS

How we might meet the goals of the department:

Goal #1 ï We developed three different versions of the pre-post test and have used each, improving it. The first version (Appendix A) had no material from BI 108, and two of the questions used di5(xppp)-7(e)4(r

Goal #4 ï We evaluated the performance of seniors in the seminar course Bi 482 during the spring and fall of 2006. The evaluation rubrics were distributed to all faculty and evaluations of both the seminar and poster were made and tabulated. We decided that having all faculty evaluate all seniors on oral presentations, posters, and papers was overly time consuming to acquire the data necessary, and are working to develop simplified rubrics.

*18. Variation	56	80	76	93
*19 Endosym	14	17	90	69
20 Nat Sel	7	46	50	33
Total Average	23.11%	63%	61.15%	60%
Last year (A)	28.4	78.8	NA	75.6%

As compared to last year, all scores were lower. It is possible this is in part due to the more time consuming test (with many questions students could not answer). The EE students averaged 49% on the 60 point test at the time of the final, while the same group averaged 63% on the 26

conclusions than in the other two categories. The overall point average was 11.83 out of 15. Data suggest that a cutoff of around 10 points could be used as an indicator of teaching success to be used for data evaluation and curriculum improvement decisions.

Table 1 ï The mean +/- Standard Deviation received after Biology Department Faculty evaluated the papers of 20 students during the Spring Semester 2006. Most papers were evaluated by 2 different faculty.

We did not have papers from the same students from BI 105 and the course that included a research project to make comparisons and analyze changes. We will be able to do that starting in the Fall of 2008. Papers from senior seminar were not evaluated according to the same rubric in Fall of 2006 and Spring of 2007, as faculty were not satisfied with the rubric. We are working on a new rubric, and will have it developed for use in fall of 2007. That rubric will be used to evaluate three papers from each student from BI 155, an upper level course with a required student project, and the senior seminar paper, once the student completes senior seminar.

Goal #4. *Be able to present in oral or written form a completed research project, using testable hypotheses, logical arguments and appropriate methodologies and equipment.*

This goal is assessed by means of a poster and an oral presentation in the Senior Seminar Course. Students are required, using either personally conducted wet bench research or using published literature, to develop a testable hypothesis and then proceed to develop a logical argument supporting or falsifying that hypothesis. This is often easier to do with experiments actually performed by the student. During the spring semester 2006, twenty students were evaluated, and 13 in Fall 2006 (Fig. 1).

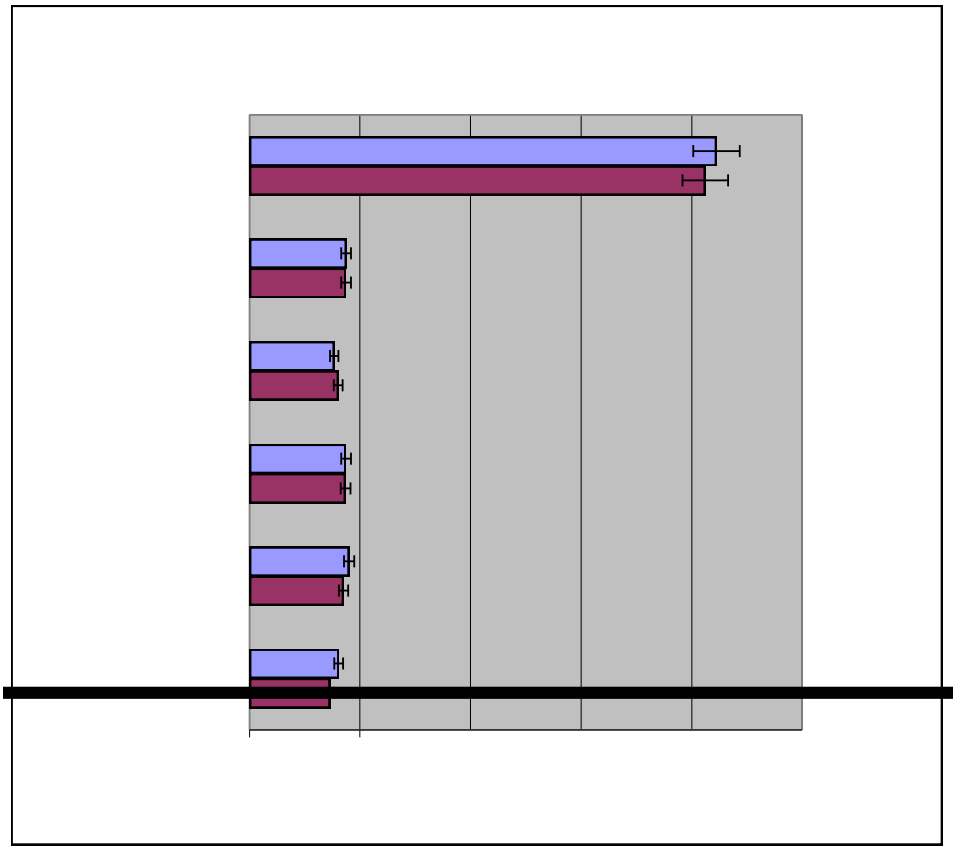

Figure 1. Mean scores for different areas of oral evaluation, a total of the five areas was determined and averaged for spring and fall of 2006.

Prior to their oral presentation, students constructed and displayed a poster using guidelines appropriate for a national meeti a dwldin4(a)bv4(s wa)-iT4n renvalua(e)4(dbl)-97(y)20 na lleato twoe fayF93(i)-

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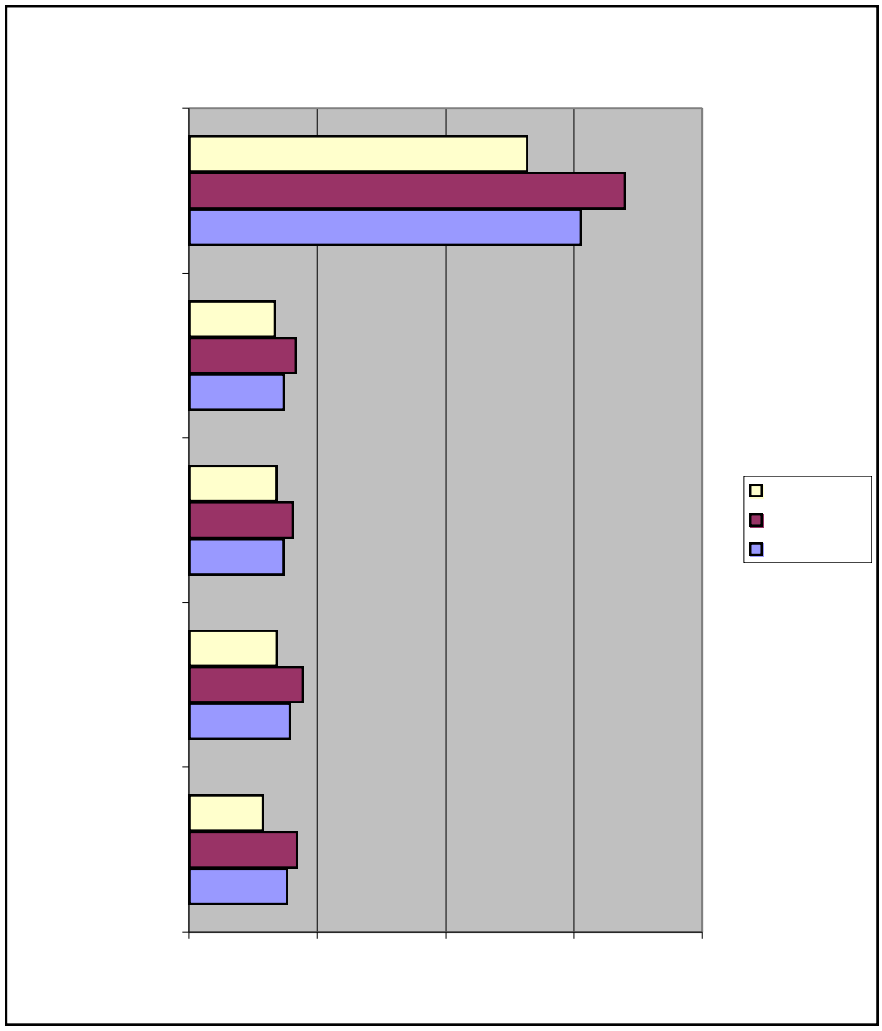

Figure 2. Mean poster evaluations scores for each area of evaluation and Totals for fall 2005, spring 2006, and fall 2006.

Report Summary

Overall it appears that we have set realistic goals and that progress is being made toward achieving these goals.

Goal 1. Freshmen students demonstrated a more than 25% improvement in their knowledge of evolutionary principles and from the test results of graduating seniors, this knowledge appears to be retained. Our third version (Appendix C) of the pre-post test will be used from spring 2007 on. Biology faculty are successfully showing how evolution is incorporated into their majors courses, improving from less than 20% to 75-80% demonstrating how their courses directly relate to evolutionary concepts. Green to yellow light.

Goal 2. In the fall of 2005, 162 and in the spring of 2006, 187 biology majors took upper division classes that meet the criteria for goal #2. Of these students, roughly 16% did not meet the minimum grade expectation of C. With a change to a minimum of ñC-ñ, less than 10% of students would have to retake one of the content area courses. Although we will not require the 6 content areas of students who are sophomores through seniors at this time, we will put tally sheets into each student folder to keep track of distribution of courses and

grades. Faculty advisors will be responsible for completing the sheet for each student they advise. At the end of the year, results will be evaluated. Yellow light.

Goal 3. Results assessing the critical skills of our students using scientific reports show that our seniors have developed the skills we feel are necessary for them to succeed in their future career. The average score for evaluating paper format, design and conclusions was 12.25 out of 15. This exceeds the minimum cutoff value of 10 which indicates we are providing satisfactory instruction for students to excel in this area. We collected BI 155 papers from all 2005-06 freshmen to put in their portfolio folders, and will ask them to include a research paper if they take a course requiring a project. These papers will be evaluated with the rubric at the time of their senior seminars. Yellow light, as we have not acquired the materials yet.

Goal 4. Average oral presentation scores were above the cut off value we established of 20 for both semesters tabulated, for a ñgreen lightò. In the spring of 2007, only one faculty member graded senior seminar performance. Oral presentation grades averaged 87% for 16 students, ranging from 70-96%. Although the rubric was not used, similar criteria were used, and the rubric ñcut-offò for a green light was 20/25, or 80%. Poster scores fell below the 15/20 for a ñgreen lightò in the fall of 2006, while the mean was well above 15 in Spring 2006. Poster mean grades were 69%, ranging from 0-95% in spring 2007. Two students failed not only the poster but also the whole one credit course, and will repeat senior seminar in the fall.

APPENDIX A

Evolution and Natural Selection Survey – Biology Department

Name_____

1. Natural populations of organisms that can interbreed and produce fertile young and are reproductively isolated from other such groups are known as _____.
2. A change in frequency of a particular trait in a population over time is_____.
3. A particular structure, behavior, or physiological function that allows organisms possessing it to survive and reproduce more than individuals in the population that lack it _____.
4. A permanent change in a cell's DNA, usually caused by errors in copying the DNA, that is the raw material for evolution_____
5. A structure with similar function but different ancestral origins is a(n)_____ structure. (Example: bee's wings and bird's wings)
6. A structure that no longer has a function in an organism, that has a function in related organisms, is a(n)_____structure. (Example: pelvic bones in whales)
7. What is **the** mechanism of adaptive evolution?_____
8. The apparent similarity between marsupial mammals in Australia and ecologically equivalent mammals in other parts of the world is an example of _____ evolution.
9. _____ came up with a theory of evolution by natural selection independently of Darwin, and caused Darwin to hurry to publish.
10. Divergent evolution in which two species evolve away from one another, acquiring greater differences, as a result of competition or the risk of lowered survival and fertility caused by hybridization_____ _____
11. _____ wrote *Principles of Geology,* a book that Darwin took with him on his voyage and convinced him that the earth is old enough for evolution to have occurred.
12. The five major mechanisms of evolution are:

    _____
    _____
    _____
    _____
    _____

13. A type of natural selection that acts to eliminate one extreme from an array of phenoptypes is called_____ selection.
14. A type of natural selection that eliminates intermediate phenotypes while favoring both extremes is called _____ selection.
15. The evolutionary history of an organism, represented in the form of an evolutionary tree, is called _____.
16. The genetic contribution of an individual to succeeding generations, a relative term comparing the contribution of one individual to others in a population gene pool _____.
17. A type of symbiosis in which both partners are benefited is _____.
18. A type of symbiosis in which one partner is benefited and the host is harmed is _____.

19. Explain the mechanism of natural selection using conditions that lead to adaptation. (essay)

APPENDIX B

Evolution and Natural Selection Survey – Biology Department

Name_____

21. Classify a human from the taxonomy category just below domain t

APPENDIX D

Biology
Content
Category
Courses

Tentative for Fall 2007

revised 1

	Ecological Journey	Neurobiology	Immunology		
	BI 404	**BI 326***	**BI 322**		
	Evolution	Plant Biology	Neurobiology		