

Academic year: 2006-07

Department/Program and Degree: **Bachelors degree in Microbiology (CIP 260502)**

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Date submitted: 3/2/2008

Website link - <http://www.ksu.edu/biology/forms.html>

### 1. SLOs proposed for assessment during previous academic year

- 1) *Awareness of the diversity of life, the evolutionary processes which result in that diversity, as well as the evolutionary relationships and ecological linkages of living organisms.*
- 2) *Ability to think critically and to integrate factual and conceptual information into an understanding of scientific data.*

Program SLOs	University-wide SLOs (Undergraduate Programs)				
	Knowledge	Critical Thinking	Communication	Diversity	Academic / Professional Integrity
Awareness of the diversity of life, the evolutionary processes which result in that diversity, as well as the evolutionary relationships and ecological linkages of living organisms.	X			X	
Ability to think critically and to integrate factual and conceptual information into an understanding of scientific data.	X	X	X		

### 2. Measures used, the sample of students from whom data were collected, the timetable for the collection, and the forum in which the measures were administered.

All measures are **direct**. In 2006 there were approximately 50 students in this degree program. Timetable – AY 2006-07.

**SLO #1** – A 15 question test, to be given at the beginning and at the end of the semester to students in the introductory course in this curriculum (General Microbiology, BIOL 455) was developed and administered for the first time in fall 2006. A total of 124 students took the exam in fall 2006; 6 of these were Microbiology majors. Based on some problems that were identified in these first two iterations of the assessment test, an improved 20-question version was developed and delivered for the first time in the spring of 2007. Direct comparison of the results from these two different tests is not possible, but it was felt we would be more confident in interpreting results from this instrument if we improved the test at this juncture. A total of 109 students took the assessment exam in the spring of 2007; only 3 of these students were microbiology majors. A copy of the instrument is available upon request.

**SLO #2** – A 16-question problem set was given, during the lecture portion of the class, to students in Modern Genetics (BIOL 450). A total of 142 students took the exam in fall 2006; only 3 of those students were Microbiology majors. Unfortunately we have no data for the spring of 2007. The instructor at the beginning of the semester (Dr. Jyoti Shah) failed to give the assessment exam at the beginning of the semester; by the time that this was discovered, it was

too late to administer the exam. Dr. Shah was in the process of leaving KSU to take another position in Texas; his attention to his instructional duties may have been less than it should have been. Steps have been taken to ensure that all instructors in the course are aware of the importance of this assessment exam. A copy of the instrument is available upon request.

**3. Results - SLO #1** – The Division of Biology uses the **gain in learning** metric in assessing student learning for this SLO (see references below). This factor is calculated as follows

$$g = \frac{(post - pre)}{(100\% - pre)}$$

The 15-question exam given in the fall of 2006 indicated a gain in learning ( $g$ ) of 0.33 for all the students in the class ( $n=124$ ); for Microbiology majors ( $n=6$ ), the gain in learning was 0.38. The 20-question exam given in the spring of 2007 indicated a gain in learning of 0.52; for Microbiology majors ( $n=3$ ), the gain in learning was 0.57. Since these sample sizes are small, it may take several semesters before we can make reasonable conclusions based on this assessment instrument. Nevertheless, it does appear that Microbiology majors are learning at levels at or above the level of the average student in the class.

**SLO #2** – A total of 210 students took the exam during the 2005-2006 academic year; the data in the first data column in the table below (AY 05-06) are pooled results from the fall of 2005 and the spring of 2006. Average gain in learning ( $g$ ) was 0.36 for the entire class in 2005-2006, and 0.35 for the Microbiology majors in the course. Average gain in learning in the fall of 2006 was 0.41, and 0.34 for the Microbiology majors in the course ( $n=3$ ). For individual questions, the gain in learning ( $g$ ) for the entire class is shown in the table below; the results for the Microbiology majors were not significantly different from the results for the entire class in either semester. Given the small sample size, this comparison is not really useful. It will again take several semesters of data-gathering before we can feel confident in interpreting these results. **All** of these questions are relevant to this SLO.

Concepts that were not learned particularly well in the 2005-06 academic year (e.g. questions 2, 3, 6, 9, 10, 12, 13 and 16) were given additional attention in 2006-07. In some cases this additional attention may have resulted in improved learning (e.g. questions 2, 3, and 6); in other cases the results were similar to (or even lower than) results from the previous year. Obviously there are many possible reasons, and many variables, that could explain these observations. However, these particular concepts will be additionally emphasized by faculty members teaching in subsequent semesters. All instructors in the course (two in the fall and two in the spring semesters) have examined these results and will be developing additional strategies to enhance learning for these problematic topics.

Question	topic	AY 05-06	g (fall06)
1	AT and GC percentage	0.725	0.76
2	AT and GC ratios	0.33	0.73
3	monohybrid cross	0.165	0.61
4	dihybrid cross	0.565	0.78
5	Hardy-Weinberg	0.63	0.29
6	RNA sequence	0.335	0.62
7	translation	0.56	0.59
8	translation with deletion	0.565	0.62
9	human pedigree	0.225	0.06
10	cell cycle	0.045	0
11	acatalasia phenotype	0.5	0.55

Question	topic	AY 05-06	g (fall06)
12	acatalasia genetic counseling	0.215	0.21
13	metabolic pathway	0.115	0.18
14	restriction enzyme recognition site	0.6	0.74
15	restriction enzyme fragments	0.495	0.53
16	chromosomes & DNA	0.13	0.13

**4. Process for faculty review of results** – *In both cases the results were shared with the faculty instructors for the course, and with the faculty at large (both in text form and in discussion at a faculty meeting). Course instructors are encouraged to use these results in modifying the course or its delivery. All undergraduate program assessment data are shared with Dr. Kent Kerby, the advising coordinator for the Division of Biology, and with our Curriculum & Undergraduate Affairs Committee.*

**5. Actions or revisions planned** – *See results (item 3) above). Additionally, given the situations that resulted in missing data for a course for a semester, we will remind instructors in those courses, before the semester starts, of the importance of administering the assessment tests. Hopefully we will not have gaps in our data in the future.*

**6. Describe the effects on student learning of the previous years actions** - *It appears that changes in the delivery of certain learning objectives has improved student learning, but a data point consisting of the observations for a single year should not be over-interpreted. Many more data points (and many assumptions) will be needed before we can be confident that our adjustment of the instructional effort in these courses is responsible for improvements in student learning. However, the instructional staff for one of these courses (Biol 450) is undergoing a transition. One of the instructors responsible for the course in the spring semester (Dr. Jyoti Shah) has left KSU to take a position at another university. This additional variable may confound our ability to detect trends, since differences in instructor approaches can significantly change student learning in upper-level courses.*

**7. Given the assessment activities and results to date, describe your assessment plans for the current year (2007-8)** – *We will continue to monitor progress, using the same assessment tool and analyses, during the current academic year.*

**Addendum** – *The feedback we received on our previous report, from the College Assessment Review Committee in fall 2007, had one “concern/question” and two “suggestions”.*

*The “concern” was “It is important that all faculty members, not just the affected instructors and the advising coordinator, should be aware of the ~~Department’s~~ Division’s assessment procedures.” As noted in #4 above, we have addressed that concern.*

*The suggestions were worded thusly*

- 1) *“Is the ~~Department~~ Division including any indirect measures of assessment?”*

*No. As clearly indicated in our prior report, and in the current one (#2 above), all measures are direct. Recall that the original assessment overview provided at the outset of this process emphasized that direct measures were preferred. In addition, given that the resources needed to develop surveys or other indirect measures are significant, and given that the university provides NO resources for program-based development or deployment of indirect (or direct) measures, the Division of Biology has chosen a suite of direct measures for Program Assessment.*

- 2) “Clearly explain the results of the assessment (particularly for readers of the report who are not statisticians).”

*With all due respect, the writer of this report is not a statistician either. In addition, other than brief mentions of the fact that certain differences are NOT statistically significant, statistical measures are not utilized in the analyses or discussion. The report does emphasize numbers (which are quite different from statistics), but in general numbers are much clearer and less ambiguous than words. If the CARC members can point to **specific** instances of unclarity in the report, it will be easier to address this suggestion.*

*However, it might be useful to acquaint the CARC members with the metric used, the “gain in learning” index. The “gain in learning” ( $g$ ) metric has been used by others to measure student learning and is determined as the difference between the post-test score and the pre-test score divided by the difference between the highest possible score and the pre-test score (Hake, 1998; Cummings et al., 1999; Roy, 2003; Sundberg, 2003). Hake (1998) found that the average gain in learning for students in traditional courses in Physics was  $g = 0.23$ .*

Hake R. 1998. Interactive-engagement versus traditional methods: a six thousand-student survey of mechanics test data for introductory physics courses. **Am. J. Phys.** 66: 64-74.

Cummings K., Marx J., Thornton R., Kuhl D. 1999. Evaluating innovation in studio physics. **Am. J. Phys.** 67: S38-S44.

Roy H. 2003. Studio vs. interactive lecture demonstration—effects on student learning. **Bioscene** 29: 3-6.

Sundberg M. D. 2003. Strategies to help students change naïve alternative conceptions about evolution and natural selection. **Reports of the National Center for Science Education** 23(2): 23-26.

**Alignment Matrix** – For each stated student learning outcome, where does the student have the opportunity to learn the outcome and where is student achievement of the outcome is assessed?

<b>SLO/Required Courses/experiences</b>	BIOL 198	BIOL 455	BIOL 450			
<b>Degree program Slo's</b>						
Awareness of the diversity of life, the evolutionary processes which result in that diversity, as well as the evolutionary relationships and ecological linkages of living organisms.	X	XA	XA			
Ability to think critically and to integrate factual and conceptual information into an understanding of scientific data.	X	X	XA			
Ability to use the scientific method to distinguish between fact, fiction, and faith.	X	X	X			
Ability to communicate biological scientific understanding effectively with individuals who do not have a scientific background.		X	X			
Ability to apply mathematical or statistical approaches to understanding biological information.			X			
An understanding of and appreciation for the role of biological science in a modern society.	X	X	X			
An understanding of the uses and limitations of laboratory techniques used in modern microbiological research.		X	X			
<b>University Slo's</b>						
Knowledge	X	XA	XA			
Critical thinking	X	XA	XA			
Communication	X	XA	XA			
Diversity	X	XA	X			
Academic and professional integrity	X	X	X			

Place an “X” for courses or experiences in which students have the opportunity to learn the outcome.

Place an “A” for courses or experiences in which student performance is used for program level assessment of the outcome.