Academic year: 2006-07
Department/Program and Degree: ***Bachelor's Degree in Biology (CIP 260101)***
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Website link - http://www.ksu.edu/biology/forms.html

1. **SLOs assessed during previous academic year**

	University-wide SLOs (Undergraduate Programs)				
Program SLOs	*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 485 students in this degree program.*

SLO #1 – *An assessment test was devised in the spring of 2006, to be given to all students in Organismic Biology (BIOL 201). This course (the first majors course in our core sequence) historically is taught in two parts, by two different instructors, one covering animals (zoology) and the other covering plants (botany). Because this is a team-taught course, and because the two faculty members in the spring teach somewhat differently than those who teach in the fall. it became clear after the test was administered last spring that there were some problems with variable coverage of some topics on the test. It also became clear that it needed to be revised with considerably more attention to the individual student learning outcomes that it was supposed to assess. The test was re-written, which means that prior data cannot be directly compared to current and future data. Therefore the data presented herein should be considered incomplete and preliminary. A total of 94 students took the test in the fall of 2006; 48 of these were Biology majors. Unfortunately we have no data for the spring of 2007, because the test given at the beginning of the semester was the previous version. By the time this was discovered it was too late to administer the correct version. A copy of this 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 06; 51 of*

those students were Biology 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*

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

question	g (spring 2006)	g (fall 2006)
2	0.51	0.86
3	0.74	0.61
4	0.58	0.58
5	0.46	0.78
13	0.42	0.44
16	0.81	0.51
19	-1.31	0.1
20	0.68	0.38
21	0.49	0.27
22	0.48	0.28

The data collected to date are found in the table at right, showing the gain in learning (g) for all students in the class. Data from spring 2006 are also presented for comparison. The relevant questions for this SLO are numbers 2, 3, 4, 5, 13, 16, 19, 20, 21, and 22. The g parameter is "gain in learning" as defined above; this can have a maximum value of 1.0 (indicating that the students learned the material perfectly). The g value for the entire class on all questions was 0.37, the g value for Biology majors was 0.39, which is not statistically significantly different from the value for the entire class. It appears that students are learning this material well, for the most part (a g value of 0.5 or above indicates substantial learning). Results for questions 19, however, indicate that instructors need to address plant evolutionary biology more specifically, and this was brought to the attention of the instructors. The results from the fall of 2006 (and preliminary results from the fall of 2007) indicate that this approach has been successful. However, on several of the other questions (notably 20, 21 & 22) the gain in learning was lower than in the previous semester. It is hypothesized that this observation results from the relatively loose coordination between the coverage of various topics by the different instructors in the different semesters. Steps have been taken to remedy this result, based on that hypothesis.

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 0.37 for the biology majors in the course. Average gain in learning in the fall of 2006 was 0.41, and 0.47 for the Biology majors in the course (n=34). For individual questions, the gain in learning (g) for the entire class is shown in the table below; the results for the biology majors were not significantly different from the results for the entire class in either semester.* ***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
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 – *The results were shared with the faculty instructors for the courses mentioned above, and also 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. We will also assume that the effects of the addition of resources (technology, coordination oversight) to BIOL 201 will be beneficial (see #6, below). Finally, given the situations that resulted in missing data for both courses 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. In addition, in the fall of 2007 we added two significant variables to the mix for BIOL 201. We updated the teaching lab (it is now a technology-enabled lab), and we appointed one of the fall instructors (Dr. Spencer Tomb) as an overall coordinator for both semesters of the course. It is hoped that these adjustments will also benefit the students in the course, and improve student learning, but these are unrelated to our other actions described in this report.*

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. We will continue to discuss*

ways to teach key concepts in both courses mentioned above, based on discussions with the instructors in the courses and other interested parties in the Division of Biology.

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?

SLO/Required Courses/experiences	BIOL 198	BIOL 201	BIOL 450			
Degree program Slo's						
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			
University Slo's						
Knowledge	X	XA	XA			
Critical thinking	X	XA	XA			
Communication	X	X	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