

## Office of Academic Program Assessment, Office of Academic Affairs The 2012-2013 ANNUAL ASSESSMENT REPORT TEMPLATE

All annual assessment reports should be submitted by the academic unit (College/Department/Program) to the College Dean for review and onward transmittal to Academic Affairs. Reports are due in Academic Affairs no later than **July 1 each year** in electronic format.

Please directly answer the following questions and make sure the answers to each question are written in a way that is easy for the general public and for the students, faculty, staff, and administrators **to understand and to use**. To ensure that the various readers have enough information to **evaluate all parts of the report** -- the learning outcomes, the methods/data, the criteria/standards of performance, the interpretations, and the conclusions -- please make sure you provide explicit information including how you have selected your sample (e.g. students or their work) and how you have analyzed and interpreted the data. There is no specific length expectation, although conciseness should be the goal.

1. As a result of last year's assessment effort, have you implemented **any changes for your assessment including learning outcomes, assessment plan, assessment tools (methods, rubrics, curriculum map, or key assignment etc.), and/or the university baccalaureate learning goals?**

a. If so, what are those changes? How did you implement those changes?

Last year, we piloted the EDAT (Experimental Data Assessment Test) writing assignment for the first time, administering it as an "extra" assignment at the end of the semester to students in selected courses (introductory, mid-level, and upper level courses). Although a useful pilot, we discovered several impediments to success: students put little effort into "extra" assignments; students in BIO 1 are not necessarily "Freshmen" (and we needed more information about the backgrounds of students to be able to place them in a "treatment group"); allowing instructors to adjust the prompt to fit their course content yielded variable results that could not accurately be compared; the standard EDAT Scoring Rubric did not fit our learning outcomes well.

For the 2012-2013 academic year, the following changes were made:

- The EDAT was altered to allow for the same prompt to be used at all levels of evaluation (freshmen to senior)
- Students participating in the EDAT did so as part of an existing course, in an attempt to increase student investment in the assignment
- Target courses were limited to BIO 1 (first course taken by all majors) and BIO 188 (capstone required or elective course for all concentrations within the major)
- Students provided their Student ID, and were queried about prior courses they had completed to determine the authenticity of treatment groups (e.g. students in BIO 1 who had taken many other BIO courses were not included in the "Freshman" treatment group)
- the EDAT grading rubric was adjusted to reflect the specific LO's emphasized by our program

b. How do you know if these changes have achieved the desired results?

Data from the EDAT, administered to incoming Freshmen (via BIO 1, Fall 2012; n=22) and graduating Seniors (via BIO 188, Spring 2013; n=48) were compared, and after randomized, blinded evaluation, there is a clear difference between groups. As will be shown, Seniors scored 88% higher on the EDAT (mean score of 3.84 vs. 2.04 for Freshmen), consistent with programmatic expectations.

2. As a result of last year's assessment effort, have you implemented **any other changes at the department, the college or the university, including advising, co-curriculum, budgeting and planning?**

a. If so, what are those changes? How did you implement those changes?

The prior assessment effort was more programmatic than specific to Learning Outcomes, as it was embedded within the IPP process; thus, some of these changes do not specifically relate to the stated LO's. However, we consider them vital to the success of our students. Changes implemented subsequent to the Spring, 2012 Learning Outcomes/IPP process include:

1. Implementation of a pre-major (designed to "catch" students who may struggle in the upper division early enough to intervene and/or advise into other majors)
2. Design of a pilot program to track all pre-majors and subject them to intrusive advising (recently approved by the Academic Policies Committee of the Faculty Senate; to commence in Fall, 2013). This pilot has the added effect of identifying "shadow majors" (those students, primarily pre-nursing, who are "pretending" to be Bio majors to escape the declaration of major requirement, but who are not actually pursuing the Bio degree). In all cases, we believe students will be better served and receive more individual attention while they are taking critical STEM "gateway" courses.
3. As mentioned above, we are certain we have a number of "shadow" majors who are specifically tied to the pre-Nursing problem on this campus. For example, we have had to make non-majors courses taken by pre-Nursing majors (BIO 25, 26, and 39) officially "off-limits" to Bio majors (who don't ever take these if they're true majors), as we had so many "majors" signing up for them. In an attempt to find a "home" for these students, the Department Chair has worked with the Chairs of Kinesiology and Health Science, Chemistry, Social Work, and others to create a degree plan for students that will use pre-Nursing course work. This degree plan has a complete course structure and the support of the Dean of HHS; it should move forward in the next academic year.
4. Individually contacting of 50 "super seniors" (as identified by the Provost's office) to assist them in filing for graduation. Advising holds were placed on all students to ensure a face-to-face meeting with the Department Chair. Of these 50 students, 44 have now filed to graduate in the next year. The remaining six are being closely tracked with intrusive advising, at times in coordination with other academic programs (e.g. SEE, the Science Educational Equity program).
5. After seeing a dismaying number of students ineligible to graduate as seniors due to a major GPA below 2.0 (ten in the 2012-13 academic year), the Department Chair initiated an awareness campaign about the problem, with instructions on how to locate the major GPA (hidden on the Academic Requirements page). This was distributed to all 1600 majors (via sacsend) and academic advisors. The Department Chair also met multiple times with CMS programmers (including Helen Norris), to advocate for a mechanism by which the Bio Department Chair can run a Cognos report to identify students as sophomores/juniors who may require intrusive advising and academic support. This program is in production, and has been promised by Fall, 2013.
6. As a result of external funding (from the National Science Foundation) and in combination with information gleaned from the IPP reports for the departments of Chemistry and Biological Sciences, faculty and students from the Department of Biological Sciences have participated in the launch of Peer-Assisted Learning (PAL) sections for CHEM 4 and CHEM 1A.

b. How do you know if these changes have achieved the desired results?

There is mounting evidence that the pre-major will do its job. For example, of the ten students who are struggling to graduate due to a major GPA below 2.0, none would have made it through the pre-major. Instead, they would have been advised as freshmen or sophomores to either engage in specific study strategies to improve their foundational learning, or routed to other majors where the mathematical and scientific rigor is not as intense.

The intrusive advising of pre-majors will flush out (we anticipate) a number of “shadow” majors, thus improving all departmental assessment processes. Of course, this is also the best thing for these students, who “float” for years attempting to gain entry into the Nursing program; instead, they should be pursuing an academic degree and graduating.

c. If no, why not?

Some of the changes mentioned above (i.e. issues related to tracking pre-majors, and obtaining a major GPA for follow-up) have not yet yielded results, as the planning and approval stages have taken most of the academic year. Moreover, as noted, some are still (as of this writing) being worked out with upper administration and instructional technology staff.

3. What **PROGRAM** (not course) learning outcome(s) have you assessed this academic year?

Via the EDAT (Experimental Data Assessment Test) writing assignment, we primarily evaluated the previously stated learning outcome *Students will be able to generate and communicate scientific knowledge*.

4. What method(s)/measure(s) have you used to collect the data?

In Fall, 2012, we implemented the EDAT (Experimental Data Assessment Test) writing assignment to 220 students in BIO 1 (Biodiversity, Ecology, and Evolution). BIO 1 is supposed to be the first course taken by majors (it is the only majors course without a pre-requisite); however, in a strange twist of curricular design, most transfer students (67% by latest measurement) arrive without having taken this course, as the introductory biology sequence requires students to take two courses at the community college as opposed to a single course at Sacramento State. So, although we had 220 students in BIO 1 complete the EDAT, only 50 were actually freshmen; this is the subgroup we chose to evaluate as our “entering” group. [Note: half of these received an altered prompt, so only 22 were used]

The “exiting” group was chosen from the BIO 188 (Evolution) course. This course, which requires completion of both BIO 184 (Genetics) and BIO 100 (Scientific Analysis), our universal “core” classes, is a senior-level course required or serving as an elective for all concentrations in the major. Ninety students in BIO 188 completed the EDAT in Spring, 2013.

Students in both courses were asked about what other biology courses they had completed, as well as their major (most of our courses also serve other majors). This allowed us to separate out biology majors, as well as identify “true” freshmen in BIO 1.

To ensure randomization and a “blind” evaluation, all EDATs were submitted in their original collection envelopes to an assistant in the Biological Sciences Department Office. She separated out the freshmen majors in BIO 1 and gave them random numbers between 1-100. She separated out majors in BIO 188

and also gave them random numbers between 1-100. In the end we had n=22 freshmen, and n=48 seniors.

Members of the Departmental Assessment Committee (five full-time faculty) met on two occasions to read and score EDATs. The first meeting served primarily as a norming session, with all faculty members reading six written submissions and then discussing the scoring. This was completed twice to ensure repeatability. After this, all remaining submissions were read by at least two faculty scorers, with the total scores averaged for each student.

One member of the Assessment Committee then compiled the scores, matching the student to their academic background with the information supplied by the student (which had not previously been reviewed by the committee).

The writing prompt was: *Advertisements for an herbal product, ginseng, claim that it promotes endurance. Describe how you would design and experiment to test this claim.*

The scoring criteria (categories) were:

- #1 Replication/Repetition of experiments included in experimental design
- #2 In/dependent variables accurately identified and discussed
- #3 Use of control group specifically mentioned
- #4 Study was blind or double blind
- #5 Randomization between control and experimental groups
- #6 Control of covariates (with covariates identified)
- #7 Statistical hypothesis testing mentioned
- #8 Other ideas mentioned that have validity to this type of study

- There were 9 points total; 1 point (max) for categories #1-7, and 2 points (max) for category #8

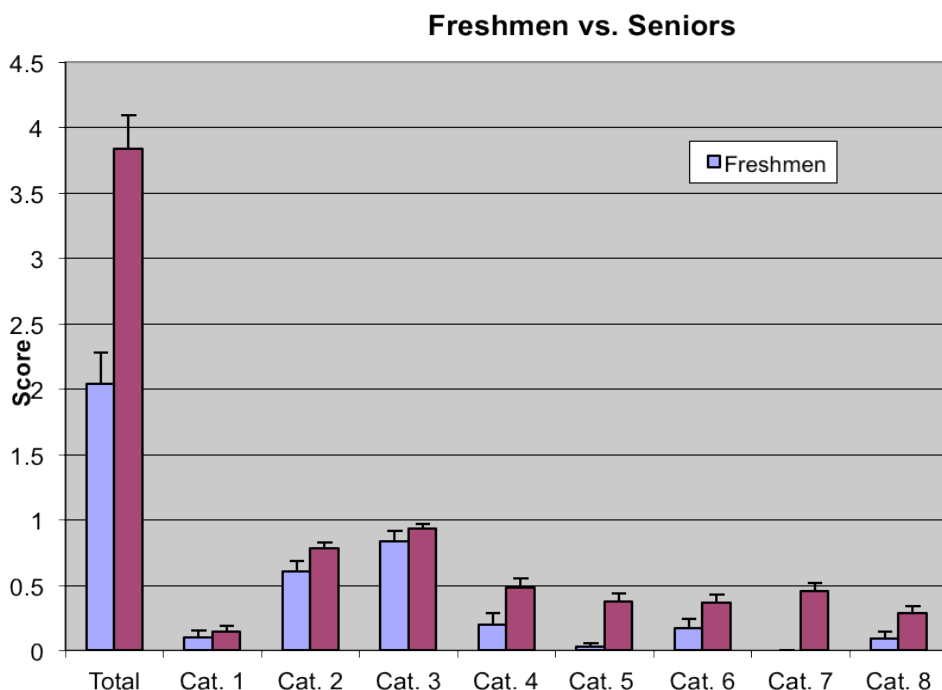
5. What are the criteria and/or standards of performance for the program learning outcome?

As this is the first attempt at using the EDAT to assess the learning outcome, “*Students will be able to generate and communicate scientific knowledge*”, we are using the data collected in this round as a baseline. Furthermore, published studies using the EDAT have noted that even tenured faculty members rarely earn perfect scores because of the subjectivity of the prompt and differences in the way that the prompt can be addressed. Therefore, we were looking primarily for differences between incoming students and those at the end of the program.

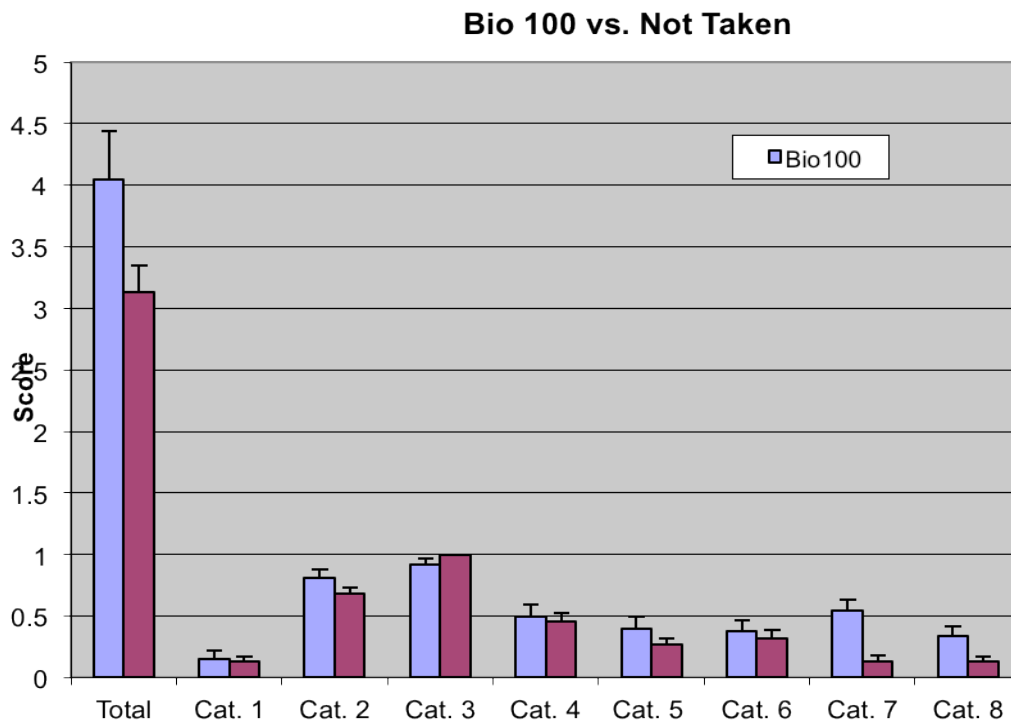
6. What data have you collected? What are the results and findings, including the percentage of students who meet each standard?

Below are the results of the EDAT scoring for Freshmen vs. Seniors. The first pair of graphs (“total”) is the sum of the average scores for each of the eight criteria that were scored in student work; the various categories are the different EDAT criteria. It is clear that seniors significantly outperformed freshmen overall, and consistently earned higher scores on every individual criterion. However, it is important to note that freshmen performed relatively well in categories 2 & 3 (an understanding of dependent and independent variables, and the importance of control groups), suggesting that students are entering with baseline knowledge in these areas. In contrast, seniors show much better performance in categories 3-8

(see above), suggesting that the coursework in our curriculum has been effective at incorporating these concepts into the curriculum.



Because students indicated on the back of their written answer sheet what courses they had already completed at the time they took the EDAT, we were also able to study the effect of particular courses on this assessment. The figure below (all seniors) indicates that BIO 100 (Scientific Analysis), a newly introduced course that is part of our Fall, 2011 curriculum revision, has had a positive effect on student performance. [n=37 had taken BIO 100; n=11 had not]



No other individual courses appeared to significantly affect EDAT performance.

The positive influence of BIO 100 on student EDAT performance supports the central role this course has been given in our new curriculum. BIO 100 has a focus on data interpretation and analysis of research literature, and student feedback indicates that they both enjoy and find value in taking it. There is additional anecdotal evidence that the new curriculum is a benefit to our students; for example, although all students presently graduating have the option of using the “old” curriculum on their graduation petitions, it is estimated that fewer than 5% do, as the new curriculum allows them to be much more efficient in their progress towards degree.

7. As a result of this year’s assessment effort, do you anticipate or propose any changes for your program (e.g. structures, content, or learning outcomes)?

### **Changes to Learning Outcomes:**

During the Spring, 2013 semester, faculty in the Department met several times to discuss the American Academy for the Advancement of Science’s *Vision and Change* Report, which outlined curricular developments and student opportunities that should be present in progressive science programs around the country. We are pleased to report that we are checking almost every box in the report with our new curriculum! After some discussion, we have a draft of new learning outcomes that will be considered for implementation in the coming year (see below). Many of these learning outcomes are implicitly embedded in our courses currently. However, we will formalize this over the coming year with explicit statements of each learning goal/outcome in the core courses in each curriculum. While the learning outcomes for core competencies (under Learning Goals 1 & 2) are relatively well defined, the learning outcomes for the knowledge domains will require some additional modification. Faculty workgroups will be identified in the next academic year to begin to define 2-3 learning outcomes for each of the sub-goals indicated.

We have also started the process of modifying our existing assessment plan to incorporate these new learning outcomes. Over the next year, we will be piloting a capstone assignment in Bio 188 that will be used to assess several of these learning outcomes on a rotating basis. For example, we will assess L.O. 1.a., 1.c., 2.a., and 2.b., using modified VALUE rubrics over the next two years in this course. While these are in the early stages of development, these learning outcomes address not only the recent changes to the curriculum as well as learning outcomes highlighted in the Vision and Change Report, but also several of the core competencies that are included in the WASC redesign.

We hope that in the next year, draft rubrics will be produced in the next academic year and we will use not only Bio 188 as a source of assessment data but also other capstone courses within concentrations, such as Bio 178 in the Ecology, Evolution and Conservation concentration, Bio 151 in the Forensic Biology concentration and Bio 145 in the Microbiology concentration.

1. **Learning Goal 1:** Students will demonstrate the ability to communicate in the Biological Sciences (Adapted from Adapted from V&C Core Competency 4)
  - a. **Written Communication:** Students will write a paper, research poster and/or research proposal in the format used in common scientific venues. This product will demonstrate adequate consideration of the purpose of the assignment, use appropriate content for the topic of the product, consistently use discipline-specific conventions, consistently use relevant and credible sources and use language that clearly conveys the meaning to readers.

- b. **Oral Communication:** Students will organize material into a clear presentation, use language appropriate to the audience, develop visual aids for the presentation and deliver a clear and consistent message.
  - c. **Information Literacy:** Students will use appropriate sources in oral and written communication. Specifically, students will select sources that are relevant to research questions, demonstrate the ability to perform an effective search, organize and synthesize information from sources, and correctly paraphrase and cite sources.
- 2. **Learning Goal 2:** Students will demonstrate the ability to apply the process of science (Adapted from V&C Core Competencies 1-3)
  - a. **Critical Thinking:** Students will state a hypothesis to be tested, provide and interpret background information in a coherent summary, recognize the complexities of the hypothesis and acknowledge opposing viewpoints, and provide a conclusion that is logically tied to the information provided.
  - b. **Quantitative Reasoning:** Students will perform necessary statistical calculations needed to solve a problem, provide accurate interpretations of results, portray results in an appropriate graphical or tabular format, and use of the quantitative information to address the specific hypothesis associated with the work.
- 3. **Learning Goal 3:** Students will demonstrate foundational knowledge in the Biological Sciences in the following core concepts (From V&C Core Concepts for Biological Literacy):
  - a. **Sub-Goal 1: Evolution:** diversity of life evolved over time by mutation, selection and genetic change
  - b. **Sub-goal 2: Structure and Function:** The basic units of structure and function define all living things
  - c. **Sub-goal 3: Information flow, exchange and storage:** The growth and behavior of organisms are activated through the expression of genetic information in context
  - d. **Sub-goal 4: Pathways and transformations of energy and matter:** Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamics.
  - e. **Sub-Goal 5: Interconnectedness and interactions of living systems:** Living systems are interconnected and interacting
  - f. Each concentration will be responsible for defining discipline-specific learning outcomes for core concepts (do we want to consider different criteria for each concentration?? For example, hold students in EEC to higher criteria in evolution, interconnectedness and interactions?)

NOTE: Although related to program assessment (rather than learning outcomes assessment), the following was also changed as a result of this year's Learning Outcomes Assessment process:

We had assumed that we would have a number of freshmen in BIO 1 who could contribute to the pool of EDAT responses, and were disappointed to see that the only freshmen in the course were those who were part of a Learning Community with a Freshman Seminar. This is due to an inappropriately high demand on the course from upper level students (primarily transfer students who did not complete the course at the community colleges), which denied freshmen students access to this first majors course.

With the help of our Dean, we lobbied for more Learning Communities, and for the Fall, 2013 semester now have three sections of Freshman Seminar (NSM 21) connected to BIO 1 (comprising 1/3 of available seats); with the help of the Natural Sciences Advising Center (NSAC), we have also targeted Freshmen from 2012-2013 who could not access the course and placed them in a remaining 1/3. The last 1/3 of the course was available for open enrollment.

8. Which program learning outcome(s) do you plan to assess next year? How?

We are currently modifying the VALUE rubrics for written communication, information literacy, critical thinking, and quantitative reasoning for use in the Biological Sciences. Based on this, we plan to pilot both the written communication and critical thinking rubrics in the next year and make modifications to these rubrics as necessary. However, our primary report next year will focus on the written communication learning outcome (Students will write a paper, research poster and/or research proposal in the format used in common scientific venues. This product will demonstrate adequate consideration of the purpose of the assignment, use appropriate content for the topic of the product, consistently use discipline-specific conventions, consistently use relevant and credible sources and use language that clearly conveys the meaning to readers.) Students will produce papers used for assessments in both the fall and spring semesters in Bio 188 classes (approximately 60-80 students per semester; 120-160 total). A subsample (50) of these papers will be randomly selected for evaluation by the departmental assessment committee. Two faculty members will read each paper independently after all readers have been normed. Papers will be scored for four different dimensions on a 1-4 scale based on performance standards in the VALUE rubrics. While still under consideration, we are considering a criterion of 70% of students earning a 2.5 or better (average of all four dimensions) to be meeting our learning outcome. Furthermore, we are hoping to have cooperation from faculty teaching capstone courses to begin to pilot the modified VALUE rubrics in these courses as this will be helpful in making necessary clarifications and modifications to the rubrics.