PROGRAM ASSESSMENT ANNUAL REPORT 2011-12

DIRECTIONS

Information from departments should be submitted as a Word Document in electronic form to both their College Dean's Office and to Claudia Pinter-Lucke (clpinterluc@csupomona.edu) no later than May 1, 2012.

SECTION I: Department Report

This section should be completed by the department assessment committee, department assessment coordinator, and/or the department chair in consultation with department faculty.

	REQUESTED INFORMATION *(Enter information for each undergraduate and graduate program on separate forms.)*	**PROGRAM INFORMATION**
1	College	**Science**
2	Department	**Geological Sciences**
3	Name of program, and type of degree (BA, BS, etc.)	**Geology; BS degree program**
4	All locations where program student learning outcomes are published (URL, ECO's, Syllabi, etc.) The URL should take the user directly to the outcomes, either their own page or the location on a more general page.	Program Learning Outcomes are posted under "Learning Objectives" at http://geology.csupomona.edu/academics.htm
5	URL where curriculum map is published. The URL should take the user directly to the curriculum map, either its own page or the location on a more general page.	A matrix that maps learning outcomes to the curriculum is posted under "Assessment—Department Learning Objectives Linked to Specific Geology Course Outcomes" at http://geology.csupomona.edu/academics.htm

	REQUESTED INFORMATION *(Enter information for each undergraduate and graduate program on separate forms.)*	**PROGRAM INFORMATION**
6	List of all DIRECT data/evidence that is used to determine students' progress on achieving stated outcomes *(Direct data/evidence is an explicit demonstration of student learning.)*	• Evaluation Spreadsheets: All Geology faculty members keep careful records of scores on homework assignments, laboratory reports, examinations and presentations—all direct measures of student achievement. In many cases this data is itemized such that it can be linked to specific program outcomes. Because such data is organized on spreadsheets it can be extracted to statistically analyze student performance related to specific learning outcomes when such information is requested. Normalizing this data between instructors teaching the same course is difficult because: 1. For upper division GSC courses one faculty member is commonly the sole instructor for the course, and 2. For courses with two or more instructors the instructor is given freedom to design his/her own assignments and examinations. • Senior thesis oral presentations are evaluated by Geology faculty using a scoring sheet. Details of efforts to evaluate and improve this process are described below in **Part 9**. • Student Evaluations: Students enrolled in all GSC courses are asked to complete an Instructional Assessment form at the end of the quarter. Responses to question #7 "Considering your level of knowledge prior to taking the course, how much have you learned this quarter? provide direct evidence of how well students believe they are achieving the course learning outcomes • Much direct data/evidence is contained in our Geology Dept. Annual Report and campus-wide IRAP data. Examples include: Numbers of student presentations Numbers of student-coauthored papers Numbers of degrees awarded Graduation rate Time to degree Pass rates in GSC courses

	REQUESTED INFORMATION *(Enter information for each undergraduate and graduate program on separate forms.)*	PROGRAM INFORMATION
7	List of all INDIRECT data/evidence that is used to determine students' progress on achieving stated outcomes *(Indirect data/evidence is information about student learning.)*	• Graduate school placement and internships: The Geology department has been very successful in placing students in prestigious graduate schools and summer internship programs. Examples from 2010-11 are showcased on our web site at http://geology.csupomona.edu/students2011.htm and will be updated during summer 2012. These student successes are a positive reflection on the Geology program and exemplify the high level at which students are achieving our seven programmatic learning outcomes • Student presentations at professional conferences: These are another positive measure of progress toward achieving outcomes of the Geology program. Refer to examples highlighted in our 2011 Alumni Newsletter: http://geology.csupomona.edu/newslet.htm • Faculty mentored student research: Geology faculty have ample opportunity to assess student outcomes achievement through working with student assistants on a multitude of research projects. Some good examples from 2010-11 are showcased at http://geology.csupomona.edu/newslet.htm • Employment: Job placement data has been compiled for Geology graduates up through 2009, with results reported on pages 6 and 7 of http://geology.csupomona.edu/AttachmentsQualitativeCriteriaGSC.pdf. The Department is in the process of updating this data base to include recent employment trends. Employment information is important for assessing the relevance of our learning outcomes to actual areas of fruitful employment. Employers hire our students because of what they have learned, thus the data provides validation here. • Scholarships are another reflection of student achievement of learning outcomes. See descriptions and photos of award ceremony at http://geology.csupomona.edu/newslet.htm

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8	At least one example **from the last two years** of a learning outcome that has been evaluated, the evaluation method used, and the data/evidence collected. Give a short description of the process used to collect and interpret the evidence.	During summer and fall of 2011, The Geology Department Assessment Coordinator participated in a workshop to pilot a rubric designed to evaluate GE Learning Outcome IIa: **"Use fundamental scientific concepts and apply mathematical / statistical models to draw quantitative and qualitative conclusions about the physical universe,"** Examinations collected from two Geology courses were scored with this rubric: GSC 111-- GE Category B1 and GSC 321/L-- Category B5Science Synthesis. Because these courses are required of Geology majors the results are applicable to our Geology BS degree program. This particular GE outcome encapsulates Geology Program Learning Outcome 7: "Utilize quantitative reasoning, experiential judgment, and computer technology to assess data, draw conclusions, and solve problems." Because the Assessment Coordinator was involved with original design of this GE rubric during Summer of 2010, he was able to devise a series of examination questions that addressed the rubric evaluation. Results from two Winter 2011 GSC 111 examinations were compiled and scored with the rubric; likewise results from two Spring 2011 GSC 321 examinations. A full report of the findings is attached (see **ReportFrom2011GEPilotFLC.pdf**). This report includes comparison between the two levels of courses, discussion of potential pitfalls in the weighting process and suggestions for rewording of the original rubric.

	REQUESTED INFORMATION *(Enter information for each undergraduate and graduate program on separate forms.)*	**PROGRAM INFORMATION**
9	At least one example **from the last two years** of a finding that <u>resulted from evaluation of an outcome</u> and how the finding was used to revise the program. Give a short description of the analysis and the conclusion.	**1.** During 2010-11 we analyzed and reported 3 years of results from a scoring sheet used by faculty to evaluate Oral Presentations of the capstone Senior Thesis. These presentations by Geology majors address **Learning Outcome 2: "Effectively communicate results of scientific investigations in written and oral format."** Faculty evaluated student achievement in separate categories of: **Organization, Slide Quality, Scientific Observations/Data, Data Discussion, Response to Questions, and Clarity/Presentation Style**. Although total faculty scores were reasonably consistent (low standard deviation) for most students, we found that each faculty member used his/her own subjective criteria to score the different evaluation categories. Thus faculty scores may differ substantially (high standard deviations) for an individual evaluation category. The conclusion here: our score sheet should be revised so it spells out specific criteria for different levels of achievement in a given evaluation category. In other words, it is recognized that this score sheet could be developed into a true rubric that might yield more meaningful assessment data. **2.** A few years ago **(GSCProgramAssessmentActivities2009.pdf)** we reported on the problem of the inordinate amount of instructor time needed to teach students how to precisely locate themselves on a topographic map in a field setting. The proposed solution (and revision of laboratory methodologies) involved GPS technology. Students were given gridded base maps and used hand-held GPS receivers that provide X-Y coordinates that could be directly plotted on the map. I have personally tested out this solution several times in my GSC 310L, 333L and GSC 491L field courses. There is a tradeoff in skills involved. In my opinion, students can no longer read topographic maps at the advanced skill level of a traditional geologist. However, they are able to plot their positions very precisely and efficiently, thereby freeing up significant time to make scientific observations.

	REQUESTED INFORMATION *(Enter information for each undergraduate and graduate program on separate forms.)*	**PROGRAM INFORMATION**
10	Description of program assessment activities to be undertaken in the next year. Be reasonable, but be active!	**1.** Redesign the Senior Thesis oral presentation score sheet so that it represents a true rubric. The main task is to establish **criteria** for specific levels of achievement in the separate evaluation categories of: **Organization, Slide Quality, Scientific Observations/Data, Data Discussion, Response to Questions, and Clarity/Presentation Style**. To guide this redesign process we will consult published oral presentation rubrics applied successfully by other science programs. **2.** Completion of a formal written Senior Thesis document (GSC 463) appears to be a bottleneck for some of our Geology majors. The thesis is especially important because it addresses all seven of our Program Learning Outcomes. Next year we intend to (a) Analyze several years of enrollment data to track student progress through the GSC 461-462-463 course sequence and determine time required to finish GSC 463, thus determining the extent to which thesis writing is a bottleneck, (b) Evaluate the existing Geology Department guidelines for Senior Thesis document, (c) Revise the thesis document guidelines as needed, and (d) Develop step-by-step procedures and benchmarks for the GSC 461-462-463 sequence and communicate this information regularly to all Geology majors. The intent of activity 2 is to streamline the thesis process for both Geology majors and Geology faculty advisors.

SECTION II: AAAITF Response

This section will be completed by one or members of the Academic Affairs Assessment Implementation Task Force.

Report from Summer 2011 GE Pilot Workshop

(Summary by Jon Nourse and Jodye Selco, March 7, 2012)

Some conclusions of the GE Pilot Learning Community:

A. General Comment

Several faculty members participating in the Learning Community were not involved in the original rubric design, so the student work products brought to the workshop did not meet the rubric criteria. GE instructors need more lead time to gather appropriate work products to score.

B. Rubric IIa Pilot Effort

<u>Methodology</u>:

We applied Rubric IIa to previously graded lecture examinations retained from three Winter or Spring quarter 2011 courses: GSC 321, CHM 122 and GSC 111. CHM 122 and GSC 111 are Area B1 Physical Science GE courses; GSC 321 is a GE area B5 Science synthesis course. Specific "fill-in-the blank" problems were selected for analysis. Several problems or questions addressed only one criteron (row) of the rubric. Other problems related to two or more criteria. Raw scores for each problem/question were normed to fit achievement levels 0, 1, 2, or 3 of the rubric.

<u>Results and Interpretation</u>:

Results from the three GE courses are compiled in the attached spreadsheet.

The evaluation process yielded a range of scores consistent with the level of the course; e.g., GE Area B1 Introductory vs. B5 Science Synthesis. The average score for GSC 111 was **1.62**, compared with **2.16** for GSC 321. This result might be expected because GSC 321 is a synthesis course for junior and senior level General Education students who have attained greater scientific experience from taking lower level Physical Science courses. The average rubric score for CHM 121 was **1.97**, statistically lower than the mean for the synthesis course.

An unresolved consideration is how to generate a representative mean score for the whole course. Some kind of weighting process is necessary because certain criteria (rows) were scored more frequently (more applicable questions) than others. Certain problems addressed all criteria in the rubric. The trick is to figure out how to rate the responses appropriately and scientifically.

C. Comments regarding applicability of the Rubric IIa (the version designed during Summer 2010)

Rubric IIa might work more effectively with some moderate changes to make the rubric more inclusive to a greater number of GE science courses:

(1) Reword Criterion C to "Utilize/Apply/Build equations/models", where models include "visual representations of data that don't need to be mathematical"

(2) Reword Criterion D to "draw conclusions from evidence" (rather than data or mathematical analysis); in this same row, rather than "physical universe" use "observed natural phenomena" or "real world" to avoid confusion of Universe with the discipline of Astronomy;

(3) Perhaps insert a 5th criteria row (after Criterion B) to evaluate skills of reading and interpreting graphs and charts. It is believed that many GE science courses teach students to read existing charts and graphs rather than building these from scratch

Our suggested revision of the Outcome IIa Rubric, with 5 Criteria, is attached. Changes from the original rubric are shown in red type.

In future application of the revised rubric, instructors may find that one (or perhaps two) of the five criteria are not specifically addressed in their course. In such cases, rather than presuming that the rubric is irrelevant, the relevant criteria should still be scored to yield useful data. Then a normalizing procedure can be applied so that rubric results based on 3 or 4 criteria can be compared with those based on five.

GE Outcome IIa Rubric Results: Summer 2011 Pilot Activity

Faculty Evaluators: Jon Nourse and Jodye Selco

GE Course	Homework or Exam Problem Evaluated	Pertinent Rubric Criteria (row)	# of Level 0 Responses	# of Level 1 Responses	# of Level 2 Responses	# of Level 3 Responses	Mean Class Score (from 0 to 4)	Comment
CHM 121	#1-Unit Conversion	C	6	0	5	35	**2.5**	
CHM 121	#3-Atomic Structure	B	9	0	5	32	**2.3**	modified to fit reading charts
CHM 121	#7-Balancing Equations	A	1	2	43	0	**1.9**	
CHM 121	#8-Mass of Product	C	6	1	4	34	**2.4**	
CHM 121	#10- Limiting Reactant	C	11	4	10	21	**1.9**	
CHM 121	#12-Concentration/Titration	C	3	12	5	25	**2.1**	
CHM 121	#14-ID Precipitation Reaction	A	1	5	40	0	**1.8**	
CHM 121	#15-ID Redox Reaction	A	9	14	22	0	**1.3**	
CHM 121	#18-Volume of Gas Produced	C	3	4	6	32	**2.4**	
CHM 121	#21-Electron Configuration	B	5	14	0	25	**1.9**	modified to fit reading charts
CHM 121	#22-Ionization Energy Na/Mg	A	21	8	4	13	**1.2**	
CHM 121	#23-Lewis Dot Structures	C	3	10	11	23	**2.2**	
CHM 121	#24-Resonance Structures	C	18	2	4	21	**1.6**	
Normalized Results							**Arithmatic Mean = 1.97 , but Weighting Procedure Not Yet Determined**	

GE Course	Homework or Exam Problem Evaluated	Pertinent Rubric Criteria (row)	# of Level 0 Responses	# of Level 1 Responses	# of Level 2 Responses	# of Level 3 Responses	Mean Class Score (from 0 to 4)	Comment
GSC 111	HW #1-Pangea Reconstruction	A, B, C, D	4	13	28		**1.5**	Addresses full rubric at maximum of Level 2
GSC 111	HW#2-Plate Boundaries	A, B, C, D	2	8	35		**1.7**	Addresses full rubric at maximum of Level 2
GSC 111	Exam 1, #5a-Silicic vs. Basaltic Volcanism	D	4	18	24		**1.4**	Measures maximum of Level 2
GSC 111	Exam 1, #7-Tectonic Drift of India	C	9	18	10	9	**1.4**	Measures maximum of Level 3
GSC 111	Exam 1, #8-California Fault Map	A, C	5	12	29		**1.5**	Measures maximum of Level 2
GSC 111	Exam 1, #3-Subduction Zone Drawing	A, C, D	4	20	22		**1.4**	Measures maximum of Level 2
GSC 111	Final Exam- Repeat Subduction Zone Drawing	A, C, D	4	7	34		**1.7**	Measures maximum of Level 2
GSC 111	Final Exam #4-Petroleum Exploration Targets	A, C, D	9	9	11	17	**1.8**	Measures maximum of Level 3
GSC 111	Final Exam #7-Groundwater Flow Section	A, B, C, D	0	16	7	23	**2.2**	Addresses full rubric at maximum of Level 3
Normalized Results							**Arithmatic Mean = 1.62 , but Weighting Procedure Not Yet Determined**	

GE Course	Homework or Exam Problem Evaluated	Pertinent Rubric Criteria (row)	# of Level 0 Responses	# of Level 1 Responses	# of Level 2 Responses	# of Level 3 Responses	Mean Class Score (from 0 to 4)	Comment
GSC 321	Exam 2, #1-Coulomb's law	A, B	0	10	30		**1.8**	Measures maximum of Level 2
GSC 321	Exam 2, #5-Hogback Landslide Safety Factor	A, B, C, D	2	5	17	16	**2.2**	Addresses full rubric at maximum of Level 3
GSC 321	Exam 2, #6-Rock Bolt Derivation	A, C	4	10	10	16	**2.0**	Measures maximum of Level 3
GSC 321	Exam 2, #7a-Rock Slide Calculation	A, C	3	5	9	23	**2.3**	Measures maximum of Level 3
GSC 321	Exam 2,#7b-Geometric Assessment	D	0	8	12	20	**2.3**	Measures maximum of Level 3
GSC 321	Final Exam, #2-Reservoir Volume	A, C	2	6	18	14	**2.1**	Measures maximum of Level 3
GSC 321	Final Exam, #4-Topo Map w/Stereonet Interp.	A, B, C, D	0	9	13	18	**2.2**	Addresses full rubric at maximum of Level 3
GSC 321	Final Exam, #6-Gravity Dam Safety Factor	A, C, D	0	2	17	21	**2.5**	Measures maximum of Level 3
							17.3	
Normalized Results							**Arithmatic Mean = 2.16, but Weighting Procedure Not Yet Determined**	

Rubric for General Education Outcome IIa—Final Version Winter 2011

Use fundamental scientific concepts and apply mathematical/statistical models to draw quantitative and qualitative conclusions about the physical universe.

Evaluators are encouraged to assign a zero (0) to any work sample or collection of work that does not meet Introductory (cell one) level performance.

Criteria	PERFORMANCE LEVELS		
	Introductory	Developing	Advanced
	1	2	3
A. Relate scientific framework or theories or principles to problem solving	States and articulates meanings of specific scientific principles or concepts, but applies them to specific data, observations, or problems in a limited or inconsistent way.	Correctly applies scientific principles or concepts to specific data, observations, or problems, but shows little or no evaluation or analysis of limitations and implications of a scientific principle or concept in addressing a problem.	Evaluates or analyzes limitations and implications of a scientific principle or concept in addressing a problem.
B. Gather and organize data / information using appropriate methodologies	Locates (in publications) or observes, then compiles, valid data sets, , but does not show the ability to organize data into charts and graphs.	Organizes data into charts and graphs, using Excel or similar software, and performs statistical analyses, but often misinterprets charts/graphs.	Consistently interprets the charts/graphs correctly.
C. Utilize/Apply equations/models	Plugs numbers or data into given equations or models and solves them, but often fails to identify and set up the appropriate equations or models with correct variables.	Identifies and sets up appropriate equations with correct variables, but cannot consistently explain how different variables affect the conclusions.	Explains how different variables affect the conclusions.
D. Draw conclusions about the physical universe from data or mathematical analysis	Summarizes and evaluates quantitative or qualitative results in statements or expressions presented in appropriate units, terminology, etc., but often fails to assess validity of results or to confirm general agreement of results with previously accepted principles.	Assesses validity of results and confirms general agreement of results with previously accepted principles, but shows little or no ability to list assumptions and recognize their influence on results; make connections among similar problems; and generalize results to the physical universe.	Lists assumptions and recognizes their influence on results; makes connections among similar problems; and generalizes results to the physical universe.

Rubric for General Education Outcome IIa (revised by J. Selco and J. Nourse, January, 2012)

Use scientific concepts and apply models to draw quantitative and qualitative conclusions about the world around us.

Evaluators are encouraged to assign a zero (0) to any work sample or collection of work that does not meet Introductory (cell one) level performance.

Criteria	PERFORMANCE LEVELS		
	Introductory	Developing	Advanced
	1	2	3
A. Relate scientific framework or theories or principles to problem solving	States and articulates meanings of specific scientific principles or concepts, but fails to meet the developing level.	Correctly applies scientific principles or concepts to specific data, observations, or problems, but fails to meet the advanced level.	Evaluates or analyzes limitations and implications of a scientific principle or concept in addressing a problem.
B. Gather and organize data / information using appropriate methodologies	Locates (in publications) or observes, then compiles, valid data sets, but fails to meet the developing level.	Uses Excel or similar software to organize data into charts and graphs, and performs statistical analyses, but fails to meet the advanced level.	Correctly discusses/interprets charts/graphs that they have created.
C. Reads and interprets graphs/charts	Usually does not interpret charts/graphs correctly.	Interprets charts/graphs correctly most of the time.	Consistently interprets the charts/graphs correctly.
D. Utilize / Apply/ Build equations / models / visual representations of data	Uses equations, models, and/or representations, but often incorrectly.	Applies equations, models, and/or representations appropriately.	Constructs correct equations, models, and/or representations.
E. Draw conclusions about the real world from evaluation of evidence	Conclusions are not consistent with evidence.	Conclusions are consistent with only a portion of the evidence.	Conclusions are consistent with all of the evidence (including assumptions) and make a general statement about observed phenomena.

Reflections on Summer 2011 Rubric Pilot FLC

Faculty Evaluator: Jon Nourse, Geological Sciences Department
Date: March 7, 2012

Jodye Selco and I were tasked to apply the previously designed GE Outcome IIa rubric to student work products. I selected homework and examinations from GSC 111 (a GE Area B1 Physical Science course) and GSC 321 (an Area B5 Science Synthesis course). Student responses were normed and scored with the rubric. Tabulated numerical results are attached to our joint report.

Below are some valuable lessons I learned from the pilot process:

1. I had few issues applying the rubric, probably because I was involved with its formulation and was able to design homework and exam questions to address criteria addressed by the rubric. From discussions over the summer, it is clear that instructors asked to use the rubrics must have sufficient advance warning to design signature assignments that can be scored effectively.

2. I took a lot of liberties in the scoring approach. Certain work products addressed only one criteria on the rubric; other problems related to two or more criteria. A few problems covered the full rubric. It turned out that several work products from my GSC 111 course only measured learning achievement to a maximum of Level 2 on the rubric—these are noted on the spreadsheet. I don't think this is a bad thing given the basic level of the course—it is difficult to design questions that hit the more advanced levels specified in the rubric.

3. There was one opportunity to compare student responses between Exam # 1 and the Final Exam in GSC 111. Students showed a statistically significant gain from 1.4 to 1.7 on the subduction zone drawing, (where 2.0 was the maximum achievable level).

4. Jodye and I both noticed it was difficult to find problems that addressed Criteria B "Gather and organize data / information using appropriate methodologies." We believe that many GE science courses teach students to read existing charts and graphs, but may not ask students to gather the data and generate charts from scratch. To make the rubric more inclusive to a greater number of GE science courses we recommend adding a fifth criterion to evaluate skills of reading and interpreting graphs and charts.

5. An unresolved question is how to generate a representative mean score for the whole course. Some kind of weighting process is necessary because certain criteria (rows) were scored more frequently (more applicable questions) than others. Certain problems addressed all criteria in the rubric. The trick is to figure out how to rate or weight the responses appropriately and scientifically.

6. The wording of the original rubric is rather cumbersome and repetitive. We recommend that the GE Assessment Committee consider the suggested revision attached to our joint report. This revision addresses Item 4 above and strives to capture the gist of the original rubric. For the sake of efficiency, fewer words might be preferable.

7. I anticipate that in future applications of the rubric (revised or not), instructors may find that one (or perhaps two) of the five criteria are not specifically addressed in their course. In such cases, rather than presuming that the rubric is irrelevant (or that the course does not fit), the relevant criteria should still be scored to yield useful data. Then a normalizing procedure can be applied so that rubric results based on 3 or 4 criteria can be compared with those based on five. In this perspective a given rubric could be more inclusive to a wider spectrum of GE courses. It would be unfortunate to end up with a paucity of assessment data just because every a rubric in full does not fit a given course