**California State Polytechnic University, Pomona**
**Annual Department Report on Program Assessment Activities**
**2008-09**

**Department** Geological Sciences **Date** 7/30/09

**College** Science **Program** Geology and Integrated Earth Studies Degree Programs

In column 1, list all student learning outcomes that were addressed in some manner in the 2008-09 academic year. *It is not expected that all outcomes will be addressed in a given year.* In column 2, indicate the place in the curriculum where the outcome is addressed. *Depending on how the outcome was addressed this year, columns 3 through 5 may or may not have an entry.*

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| | | GSC faculty met several times between 2007 and 2009 to develop a matrix linking Department Learning Objectives to specific GSC courses. The matrix is posted under Assessment—Department Learning Objectives Linked to Specific GSC Learning Outcomes 2009 at http://geology.csupomona.edu/academics.htm | The matrix indicates significant coverage of all Department Learning Objectives in both the Geology and IES degree programs. A logical progression of intensity levels from introduced to developed to mastered corresponds to the increase in course number. | Although the existing Department Learning Objectives adequately address the goals of the Geology and Integrated Earth Studies degree programs, GSC faculty members used these assessment discussions to design specific Emphasis Areas (tracks) that promote strategic growth areas identified by our analysis of alumni feedback and recent hiring trends in the geosciences. |

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| | | | | Two related Curriculum Proposals were submitted during the 2008-09 cycle. These proposals currently await approval by Academic Senate:<br>1. Reorganize the Geology degree program into three tracks: Geology, Environmental and Earthquake Geophysics, and Engineering Geology<br>2. Reorganize the IES degree program into two tracks: Water Resources, and Earth and Environment |
| | | A matrix linking University Learning Outcomes to seven Department Learning Objectives (a.k.a. Program Outcomes) was created in 2008-09 and is posted under Assessment Department | The matrix indicates significant coverage of University Learning Outcomes by the aggregate of seven Department Learning Objectives. Teaching goals of the Geological Sciences Department are | No changes are needed at this time |

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| | | Program Outcomes Linked to University Learning Outcomes (2009) at http://geology.csupomona.edu/academics.htm | thus aligned with the University outcomes. | |
| | | A compilation of course-specific Learning Outcomes was completed by Geology faculty in 2008-09. http://geology.csupomona.edu/academics.htm | The process of articulating learning outcomes prompted each faculty member to reflect on the content of specific courses | |
| Topographic Map Interpretation<br><br>Pertinent Department Learning Objective:<br>F: Use maps, cross sections, and other imagery to analyze and interpret spatial and temporal relationships displayed by Earth features or geologic data sets.<br><br>Specific GSC course Learning Outcomes:<br>--GSC 141L—<br>3. Obtain basic information from topographic maps and construct topographic profiles | Introduced in GSC141L (Principles of Geology Lab)<br><br>Introduced and developed GSC 321L (Engineering Geology Lab)<br><br>Mastered in GSC 333L, GSC 491L | A 30 minute pretest on Topographic Map Interpretation was administered during the first lab meeting of GSC 321L Section 01 to determine the level of basic topographic map reading skills the CE students had previously acquired in classes such as Surveying. The same pretest was given to Section 02 lab two days later after an intervening 40 minute lecture | Student scores were tabulated, graphed and analyzed for each of the pretests, the laboratory and the Midterm exam. Section 01 pretest scores were very low, indicating very minimal preparatory experience. Pretest scores for Section 02 were significantly higher, demonstrating that students gained significant knowledge after just one | Faculty find that introducing topographic map concepts on the first day of class is most effective, also it is beneficial to continue reinforcing the concepts throughout the quarter by utilizing topographic base maps for laboratory assignments and lecture examples. The gains on the Midterm were attributed not just to student review of pretest results, but also to the |

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| --GSC 321—<br>2. Attain working knowledge and practical skills with topographic, hydrologic, and geologic maps and associated profile/cross section illustrations | | module on topographic maps. Pretests were marked and returned to students as a study guide (scores did not count toward course grade).<br><br>Laboratory exercises during weeks 1, 2 and 3 introduced additional topographic map concepts and emphasized quantitative analysis. One month into the quarter, students were asked to perform similar topographic map interpretation tasks on a midterm exam.<br><br>Laboratory exercises are evaluated by instructor, using a rubric that assigns specific points to each component of each assigned problem | introductory lecture on topographic maps. Midterm scores on topographic map problem showed gains for both groups.<br><br>The process of grading individual laboratory exercises, quizzes and exam provides instructor continuous feedback on student learning gains or misunderstandings / misconceptions as the quarter progresses | emphasis that instructors place on being able to use topographic maps as quantitative tools.<br><br>It was also noted that many CE students have not taken Surveying prior to enrolling in GSC 321. There was some discussion about requiring Surveying as a prerequisite for GSC 321, but given the impacted CE program, Geology faculty are ok with teaching the topographic map components from scratch. |

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| Topographic Map Reading and Field Location<br><br>Pertinent Department Learning Objective:<br>F. Use maps, cross sections, and other imagery to analyze and interpret spatial and temporal relationships displayed by Earth features or geologic data sets.<br><br>Specific Course Learning Outcomes:<br>--GSC 255L—<br>5. Ability to locate points of observation on a topographic base map<br>--GSC 333L—<br>4. Precisely locate structural orientation data with appropriate symbols on topographic base maps and/or satellite images | Developed in GSC 255L (Geological Field Methods)<br><br>Developed and mastered in GSC 333L (Structural Geology Laboratory)<br><br>Mastered in GSC 491L (Field Module) | The conventional assessment strategy used in GSC 255L and GSC 333L is to provide students a topographic map base for locating observation points in the field. The instructor assists students with correlating specific landscape markers with features on the map. Student learning progress is monitored periodically throughout the mapping exercise. Precision and accuracy of station locations are evaluated on the final map product. Evaluated maps are returned to students and used as a basis for reinforcing map location skills during subsequent mapping exercises. | Faculty find that a few students are able to locate themselves accurately but most struggle with attaining the desired goal. Results are marginal when working in areas with few distinct landscape markers.<br><br>Despite various tricks and techniques employed to teach map location skills, most instructors note that the time required for students to locate themselves detracts from the main goal of the mapping exercise: making geologic observations and measurements and plotting as much data as possible while in the field. A new learning method is needed to make more efficient use of time. | After much discussion, most instructors are migrating toward the use of GPS technology, which provides observation station locations to +/-10 ft. Students are provided a gridded topographic map which facilitates plotting of precise locations determined from GPS coordinates. With this location technique, more observations can be made during a day in the field.<br><br>Recent advances in GPS technology and the concurrent development of related computer graphics programs and GIS mapping software were built into the Learning Outcomes for the advanced geologic mapping course (GSC 491L--Field Module):<br>--Utilize hand held GPS |

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| | | | | units for location as well as geologic mapping,<br>--Prepare topographic and geologic maps with computer software,<br>--Integrate GPS data into in ArcGIS and other GIS programs |
| Gain Technical Proficiency with Gravity Meter and Practical Experience with Interpreting Acquired Data<br><br>Pertinent Department Learning Objective:<br>D. Acquire geologic data in the laboratory or field using standard observational procedures and scientific equipment.<br>**G.** Utilize quantitative reasoning, experiential judgment, and computer technology to assess data, draw conclusions, and solve problems.<br><br>Specific GSC course | Introduced and developed in Lab #6 of GSC 434L (Shallow Subsurface Geophysics);<br><br>Mastered during Field Exercise (Lab #8) of GSC 434L | 1. During Lab #6, students follow multi-step procedures for operating gravity meter, applying pertinent calibration tables and obtaining several gravity readings. Each student checked results with instructor before proceeding to next step. Teams of students gathered gravity measurements from different levels of Building 4 and completed report that interpreted results.<br><br>2. Field exercise | 1. Through direct supervision, instructor gained immediate feedback from each student after each step and was able to correct errors and reiterate instructions where necessary. Student reports were generally good, but it took too long for some teams to level the instrument and acquire data. Instructor also noted unacceptable drift in the gravity readings at a given station producing scatter in data that complicated the student | 1. Laboratory assignment was altered somewhat to account for extra time needed to obtain gravity data during this introductory exercise. Gravity meter was professionally serviced and recalibrated in June, 2009, so it now can be leveled efficiently and the drift problem is corrected.<br><br>2. No improvements are needed to this capstone field laboratory exercise |

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| Learning Outcome:<br>--GSC 434—<br>11. Types of gravity measurements and procedures for obtaining gravity data in the field using Department gravimeter<br>12. Common corrections applied to observed gravity measurements<br>13. Predicted gravity effects of simple geometric shapes<br>14. Analysis of gravity anomalies | | required teams of students to take gravity reading across buried geologic structures at two sites. Results were tabulated and interpreted in a formal laboratory report | interpretations.<br><br>Results of this assessment activity were confirmed by an independent faculty member during a concurrent peer teaching evaluation.<br><br>2. Highlights of the March, 2007 GSC 434 field exercise are showcased at http://geology.csupomona.edu/jpolet/Jascha_Polet_at_Cal_Poly_Pomona/Field_Photos.html Close instructor supervision during multiple steps of the experiment led to successful data acquisition and delineation of gravity anomalies. Team reports demonstrated students' ability to connect interpretations of their field | |

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| | | | measurements to gravity theory explained in lecture | |
| Oral Communication<br><br>Pertinent Department Learning Objective:<br>B: Effectively communicate results of scientific investigations in written and oral format.<br><br>Specific Course Learning Outcome:<br>--GSC 463—<br>Formal, oral presentation of senior thesis results. This presentation will be judged on clarity, organization, scientific merit and the presenter's ability to discuss and to respond to faculty and student questioning in an effective and persuasive manner. | Mastered in GSC 463 (Senior Seminar)<br><br>Introduced and developed in the many GSC courses that require presentation of oral reports: GSC 145L, 307, 320, 321, 331, 350, 434, 450, 425L, 444L, | Geology faculty as a whole evaluate the senior thesis presentation with a standard rubric. Results of the rubric are compiled , then shared with the student and his/her faculty advisor | Although some of the presentations during the past three years have been technically outstanding, faculty note that many students need to work on the style and substance of their talks. With the advances in Powerpoint, senior thesis presentations seem more focused on visual effects and less on scientific content. | A new class (GSC 410--Earth Science Seminar) was designed, submitted, and approved by the University curriculum committee during the 2008-09 cycle. This course, to be required of all Geology and IES majors, provides students practical experience with the preparation and critique of oral presentations intended to disseminate Earth science information in a professional or academic setting. Students will be instructed in methods of organizing and presenting Earth science data in an oral seminar |

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| | | | | forum. Through direct observation and critique of talks or seminars, students reinforce their oral presentation experience and skills. |
| Written Communication<br><br>Pertinent Department Learning Objective:<br>B: Effectively communicate results of scientific investigations in written and oral format.<br><br>Specific Course Learning Outcome:<br>--GSC 462—<br>Submission of a formal, written report in appropriate scientific style. | Mastered in GSC 462 (Senior Thesis)<br><br>Introduced and/ or Developed in almost every GSC course. Most require formal written laboratory reports or written research papers | One Geology faculty advisor is responsible for monitoring student progress with writing the thesis document through multiple iterations of editing. This faculty member also evaluates the final product and shares his thoughts with the student advisee<br><br>Additional feedback is provided by other GSC faculty members who evaluate the related oral presentation of the thesis (GSC 463). Appropriate corrections are made (if necessary) before posting the final document on the GSC | For some years, the endeavor of writing a formal thesis document seems to have become an arduous task and an impediment to efficient graduation of Geology majors. Many students seem comfortable presenting their research in poster sessions or informal talks, but the mechanics of writing up the formal document is a major hurdle. Some faculty members feel they have become too involved in their students' writing. At the same time it has been noted that several theses wind up being almost | After much faculty discussion, the 3-course senior thesis sequence has been redesigned and streamlined to facilitate student progress. Curriculum changes were submitted in the 2008-09 cycle. GSC 461 (renamed Senior project) entails acquisition of data associated with an earth science research project. GSC 462 (renamed Senior Presentation) involves analysis and interpretation of data acquired in GSC 461 and formal presentation of results via a poster at a professional |

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| | | Department website. | Masters level in their scope and content.<br><br>An archive of senior theses deemed by Geology faculty members to be good or excellent quality is posted at http://geology.csupomona.edu/theses.htm | conference or an oral presentation to peers and faculty. The third class will entail a required writing component. This can be satisfied by writing a formal thesis document (GSC 463--renamed Senior Thesis) or by completing one of three approved technical writing courses. |
| Recognize and Classify Minerals of the of Six Crystal Systems<br><br>Pertinent Department Learning Objective:<br>C: Recognize common Earth materials, structures, and landforms, describe their properties, and determine their age relationships.<br><br>Specific Course Learning Outcomes:<br>-- GSC 215/L--<br>2. Understand the fundamentals of applied crystallography particularly | Introduced and Developed in GSC 215/L (Mineralogy Lab);<br><br>Mastered in GSC 325/L (Optical Mineralogy)<br><br>GSC 215 is a prerequisite for GSC 325 | During the first meeting of GSC 325, students are asked to list the six crystal systems, provide an example mineral corresponding to each system, and write down its chemical formula. This quiz is scored and returned to the students. The same question is repeated on the midterm exam. | Results of the first quiz (run for several years now) typically average between 30% and 50%. Students know most of the crystal systems but struggle to associate specific mineral names with each system. Their knowledge of chemical formulas associated with minerals is generally poor, despite the emphasis on chemistry in GSC 215. | Significant gains between results of the preliminary quiz and midterm question are attributed to instructor emphasis on crystal systems and chemistry during subsequent lectures and laboratory exercises.<br><br>Optical properties of minerals are very dependent on the particular crystal system. To reinforce the connection, GSC 325 |

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| forms; symmetry operations; crystal systems and the Bravais Lattices.<br>10. Identify approximately 100 of the most common minerals.<br><br>-- GSC 325/L--<br>4. Recognize and demonstrate fundamental differences between isotropic, uniaxial, and biaxial minerals through optical tests performed with a petrographic microscope.<br>5. Utilize optical properties to identify common rock forming minerals in grain mounts and thin section. | | | Performance on the same midterm question is much better, typically 80-100% | instructor has begun asking students to write down the crystal system and chemical formula for each mineral studied or identified under the optical microscope.<br><br>Through this process of reinforcement, students are better able to associate the optical properties of a mineral with its crystallography. |
| Gain Technical Proficiency with X-Ray Diffractometer<br><br>Pertinent Department Learning Objective:<br>D. Acquire geologic data in the laboratory or field using standard observational procedures and scientific equipment.<br><br>Specific GSC course | Introduced and developed in GSC 215 (Mineralogy) | Students prepare unknown mineral sample, then analyze it with X-Ray diffractometer. The objective is to generate data that can be matched with known spectra, and identify unknown pure minerals or proportional mixtures of two minerals | Instructor evaluation of submitted lab exercises shows strong correlation between lab scores and attendance of students at supporting lectures and laboratory demonstrations | No changes in this laboratory exercise seem warranted |

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| Learning Outcome:<br>GSC 215-- Be able to utilize X-ray Crystallography to identify and index common minerals. | | The instructor monitors student progress through each step in the laboratory activity and makes suggestions or corrects procedural errors as needed. Data plots and student interpretations of mineral ID are graded and returned to students with instructor comments. | | |
| Gain Technical Proficiency with X-Ray Fluorescence Spectrometer<br><br>Pertinent Department Learning Objective:<br>D. Acquire geologic data in the laboratory or field using standard observational procedures and scientific equipment.<br><br>Specific GSC course Learning Outcomes:<br>GSC 300—<br>4. Understand the use and application of XRF to | Introduced and developed in GSC 300 (Geochemistry);<br><br>Developed and mastered in GSC 425L (Igneous and Metamorphic Petrology) | Students collect suites of samples from field areas in the Mojave desert. They prepare pellets of powdered samples and analyze them on the XRF, generating geochemical plots appropriate for the rock type. These plots are utilized to make petrogenetic interpretations which are described in a formal laboratory report. | All engaged students demonstrate acceptable competency with sample prep, operating the XRF instrument, and generating data plots. The quality of student interpretations tends to correlate with their performance in the lecture portion of the class. Minor problems are noted with students in the larger GSC 300 class who put the laboratory work off to | Instructor emphasizes the importance of analyzing samples soon after returning from the field. Efforts have been made to schedule the students for specific time slots on the XRF to avoid the bottleneck problem |

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| geochemical analysis and interpretation.<br>5. Collect and analyze rock sample/water samples and/or soil samples.<br>GSC 425L—<br>5. Collect, analyze and interpret suites of rocks from field areas. | | The instructor monitors student progress through each step in the field sampling and laboratory activity and makes suggestions or corrects procedural errors as needed. Data plots and student interpretations are graded and returned to students with instructor comments. | the last minute—occasionally there is a bottleneck in finishing the analyses before the submission deadline. | |
| Complete 8-unit Geology Field Camp or its equivalent<br><br>Pertinent Department Learning Objectives:<br>C: Recognize common Earth materials, structures, and landforms, describe their properties, and determine their age relationships.<br>D. Acquire geologic data in the laboratory or field using standard observational procedures and scientific equipment.<br>F. Use maps, cross sections, and other imagery to analyze and interpret spatial and | Developed and mastered in GSC 490 (Geology Field Camp)<br><br>Developed and mastered in GSC 491L (Field Module) | The traditional summer field camp requirement (a six-week, 8 unit course taught by another university) has long imposed a financial and time burden on our working students and hindered their efficient graduation.<br><br>To address this roadblock, in 2006 we devised the Field Module course series (GSC 491L) in attempt | After reviewing the results and progress of GSC 491L during 2008-09 faculty meetings, GSC faculty members are satisfied that students are:<br>1. Achieving the required learning outcomes, and 2. Being exposed to an acceptable diversity of geologic terrains and field mapping projects.<br><br>An added benefit is | The GSC 491L experiment is deemed to be successful in its goal of achieving a set of learning outcomes equivalent to Geology Field Camp. Other than encouraging faculty members to research new field areas and design new field projects no changes are anticipated in the future. |

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| temporal relationships displayed by Earth features or geologic data sets.<br>G. Utilize quantitative reasoning, experiential judgment, and computer technology to assess data, draw conclusions, and solve problems.<br><br>Specific GSC course Learning Outcomes:<br>GSC 491L—<br>1. Conduct geologic mapping in a variety of geologic settings.<br>2. Complete field reports, geologic maps and cross sections<br>3. Integrate their field data into a larger scale understanding of the regional geologic and tectonic picture,<br>4. Prepare a final field report that closely mimics the type of report that will be required of them as employees in the geotechnical fields. | | to achieve the same learning outcomes of Geology Field Camp by teaching the students appropriate skills in house, in smaller chunks.<br><br>The new mechanism allows students to complete the GSC 255L Field Methods course plus four Field Mapping Modules (2 units each) during junior and senior year, in lieu of Summer Field Camp. A different Field Module is taught each quarter by an individual faculty member or teams of two faculty. Four Geology faculty members have taught this course and a fifth has designed a Field Module for Winter, 2010. The responsible faculty member(s) evaluate learning outcomes of all | increased student-faculty interaction in the field, leading to higher quality senior thesis research in the GSC 461-462-463 series.<br><br>Photo documentation of recent GSC 491L Field Modules may be viewed at:<br>http://www.csupomona.edu/~marshall/CR08.Fld.Stud.htm<br>http://www.csupomona.edu/~marshall/gsc491L.coast.tect.htm<br>http://geology.csupomona.edu/janourse/StudentsInAction.htm<br><br>Since implementing GSC 491L we have noted a dramatic improvement in time to graduation and decrease in drop-out rate. About 75% of recent Geology degree recipients have satisfied the Field Camp requirement with GSC 491L. | |

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