PROGRAM REVIEW – CURRICULUM PACKET

2018-2019

GEOLOGY

This report includes course student learning outcome (cSLO) assessment summaries from 2015-16 to 2017-18.

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COURSE OFFERINGS

Table 1. Course offerings per academic year from 2015-16 to 2018-19

Course Name	2015-2016	2016-2017	2017-2018	2018-2019
GEOL G105	x	x	x	x
GEOL G106	x	x	x	x
GEOL G110	x	x	x	x
GEOL G110L	x	x	x	x
GEOL G120	x	x	x	x

COURSE ASSESSMENT STATUS

Fully Assessed	Partially Assessed	No Assessment
↑	↔	↓

Table 2. Course Assessment Status between 2015-16 and 2017-18
*No enrollment data between 2013-14 and 2018-19

Course Name	Total cSLOs	No. cSLOs Assessed	Assessment Status		Last Term Offered
GEOL G105	5	2 out of 5	Partially Assessed	↔	Spring 2019
GEOL G106	5	0 out of 5	No Assessment	↓	Fall 2018
GEOL G110	5	3 out of 5	Partially Assessed	↔	Spring 2019
GEOL G110L	5	1 out of 5	Partially Assessed	↔	Spring 2019
GEOL G120	9	3 out of 9	Partially Assessed	↔	Spring 2019

Table 3. cSLOs that were not assessed between 2015-16 and 2017-18

Course Name	cSLO Name	cSLO to Assessed
GEOL G105	cSLO 1	List, in order, major advances of life on Earth and outline the general patterns of change (life, climate, continents) through time.
GEOL G105	cSLO 2	Relate the manner in which matter occurs in nature and classify the matter into appropriate mineral and rock groups.
GEOL G105	cSLO 3	Outline recent discoveries in plate tectonics and account for various geologic processes and phenomenon with this theory.
GEOL G106	cSLO 1	Explain how the Earth's internal processes occur, how the Earth's surface processes occur, how plate tectonics occurs and the results of plate tectonics.
GEOL G106	cSLO 2	Relate how life on earth has evolved over time; how mineral resources have formed and how their extraction and distribution affects humanity; how the Earth's oceans have originated, evolved, and are studied and how the Earth's atmosphere has originated, evolved, and is studied.
GEOL G106	cSLO 3	Describe the occurrence and identification of common minerals and rocks; the origin and nature of geologic hazards: earthquakes, volcanoes, etc.; the manner in which the history of the Earth and life on

Course Name	cSLO Name	cSLO to Assessed
		Earth occurred; and the manner in which plate tectonics has been responsible for the structure of the Earth's crust and mountain building.
GEOL G106	cSLO 4	Identify the fundamental processes of physical oceanography; the role of plate tectonics with regard to sea floor features; the interactions between atmosphere, hydrosphere, tectonics, and humans; and the fundamentals of meteorology and climatology, and the history of climate.
GEOL G106	cSLO 5	Relate our solar system with planetary science and astronomy to processes, which formed the Earth and made it unique.
GEOL G110	cSLO 1	Use the scientific method to understand natural processes on Earth. Identify surface processes operating on the Earth and their products; those internal processes operating on Earth; the correlated process with phenomenon such as earthquakes ,faults, volcanism, and plate tectonics; and the manner in which inorganic matter occurs in nature from atoms through minerals and into rocks.
GEOL G110	cSLO 4	Use Geographical Information Systems (GIS). Examine topographic and geologic maps. Identify locations, distances, and elevations on standard U.S.G.S. quadrangle maps. Be able to draw a topographic profile and understand slope and gradient of terrain. Identify geologic structures on geologic maps and understand dip and strike of geological units.
GEOL G110L	cSLO 2	Describe the ways in which geology is used in society; the origin and occurrence of the Earth's valuable mineral, rock , and fossil fuels resources; and how the Earth's processes and materials effects human life as geological hazards.
GEOL G110L	cSLO 3	Identify and name unknown minerals ,and rocks through employing physical properties such as color, hardness, cleavage, streak, and special properties. Understand the differences between igneous, sedimentary, and metamorphic rocks. Distinguish between rocks based on mineral composition and texture.
GEOL G110L	cSLO 4	Use Geographical Information Systems (GIS). Examine topographic and geologic maps. Identify locations, distances, and elevations on standard U.S.G.S. quadrangle maps. Be able to draw a topographic profile and understand slope and gradient of terrain. Identify geologic structures on geologic maps and understand dip and strike of geological units.
GEOL G110L	cSLO 5	Identify land forms resulting from glaciers and glaciation periods. Understand the continuous aspects of climate change throughout the earth's history; climate with and without glaciers and ice caps. Recognize how warm and cold climates result in formation of unique landscapes, fossil fuel deposits, and fossil fauna on Earth.
GEOL G120	cSLO 1	Employ the scientific method from a theoretic prospective from lecture material and in an applied aspect from laboratory experiments.
GEOL G120	cSLO 3	Illustrate the evolution of the Earth over geologic time with respect to the development of life, ecological development, the fossil record, and past climatic impacts on fauna.
GEOL G120	cSLO 4	Illustrate the formation of continents and ocean basins, and the geomorphology of fluvial, glacial, eolian process on land forms.
GEOL G120	cSLO 6	Discuss the impacts of the San Andreas Fault on extension tectonics, and the development of the Basin and Range and the current aliforniacoastal topography.
GEOL G120	cSLO 7	Explain the formation of various mineral resources, and the formation of fossil fuels.
GEOL G120	cSLO 9	Define the development of various land forms, unconformities, and geologic strata, and how they develop as a sequence of geological events.

DATA EVALUATION

Table 4. cSLOs assessed and corresponding Data Evaluation.
*Denotes historical cSLOs.

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
GEOL G105	cSLO 4	Spring 2017	1. At the start of the class, 3% of students recognized the difference between a Richter Scale magnitude 4 and 5 earthquake, compared with 75% at close of class. 2. At start of class, 67% of students knew the age of the Earth, compared with 88% at close of class. 3. At start of class 56% of students understood directions of ocean currents, compared with 92% at close of class. 4. At start of class, 28% of students knew composition of Earth's atmosphere, compared with 79% at close of class
GEOL G105	cSLO 5	Fall 2015	Twenty eight students out of 36 were able to identify the location of strike-slip faults based on a plot of geologic fold structures and the location of oil wells.The twenty eight who received full credit were able to name specific faults (Wittier, Newport-Inglewood and San Andreas) and identify the locations of syncline and anticline folds. This question required knowledge of the geologic structure anticline, which serve as structural traps for oil accumulation. The eight students who missed the question could not name the faults, tie faults to oil basins or relate uplifted anticline folds to oil basins.
GEOL G105	cSLO 5	Fall 2017	An increase of 23% is a significant improvement, however 19% of the students failed to respond to the same question asked a second time. The format of the question was an exact copy of the question from the first exam. The 19% who missed the question had sufficient notice and the concept was repeated throughout the semester with a variety of practical applications. Some of my students fail to take notes using cell phone pictures as a study guide.
GEOL G110	cSLO 2	Fall 2015	Discussion of natural gas and fracking of oil as a substitute for gasoline derived from imported oil. Students who responded correctly to the essay question correlated natural gas deposits in the United States and known oil reserves of the world. In addition, economic incentives and cost of converting from gasoline pumps to natural gas were related to pump prices of gasoline and world oil prices.Correct responses analyzed the cost effectiveness and the reality given the current geographical distribution of natural resources throughout the world.Students who scored low on this question were not able to relate Mid-Eastern oil to recent natural gas discoveries in the United States. Some students had little to no knowledge base of current Oil prices were even though we tracked on a weekly basis crude oil market prices and compared oil pricing to gasoline pump prices in Orange County. The largest problem with this assessment is if students did not understand one part of the concept such as known reserves or pricing they missed the entire question or gave impartial responses
GEOL G110	cSLO 3	Fall 2015	This mineral was unique in that color gave a false identification to this mineral.I used a green garnet with a dodecahedron crystal form. The students were exposed to red garnets and not green. 46 of 68 correctly identified the garnet based on its crystal form. The incorrect responses 22 in all, named the mineral Epidote, Apatite, Olivine, or Augite.All these minerals exist as a green colored mineral. Incorrect response entirely missed the crystal form due to the fact that the incorrect green minerals names used by students are not in the isometric-dodecahedron crystal class. This illustrated a lack of crystal form understanding and a reliance of color as a primary mineral identification tool.
GEOL G110	cSLO 3	Fall 2016	A total of 36 students were assessed in two lab sections. Pretest scores averaged 64% with a range of 52% to 86%. The following midterm results increased to an average of 78% with a range of 66% to 92%.
GEOL G110	cSLO 3	Summer 2017	With minimal supervision, and in working in a self-directed fashion, 89% of students (16 of 18) accurately described the physical properties of the minerals and

Course Name	cSLO	Semester Assessed	cSLO Data Evaluation
			successfully identified the mineral specimens.The remainder of the students(two), while not demonstrating proficiency in the identification of the minerals, did complete the assignment and earned credit for completing the lab
GEOL G110	cSLO 5	Fall 2016	Multiple avenues of delivery seem to work well. Geology has many aspects and students grasp some topics over others dependent on student interest. The Physical Geology 110 class has an advantage over the General Geology 105 due to the lab component. The 110 allows introduction of concepts in lecture followed by a hands on application in the lab portion. Considering correct responses increased by 74% and incorrect responses dropped from 15% to 1%.
GEOL G110	cSLO 5	Spring 2018	A physical activity such as constructing a graph allows students to relate abstract number ration such as Oxygen 18/16 to warm and cold climates along with the periodicity of climate change.
GEOL G110L	cSLO 1	Fall 2017	This was a learning curve where two class of approximately 30 (52 Total) students conducted an experiment that took an abstract concept and placed itinto the hands of students who through experience observed the actual working of the Scientific Method.
GEOL G120	cSLO 2	Spring 2018	A physical activity such as constructing a poster with tectonic events life phases and environmental conditions allows student to allows students to tie concepts together.
GEOL G120	cSLO 5	Spring 2016	Students seeing actual geologic units in the field provide a visual experience surpassed by any lecture presentation.In the field we were able to relate theoretical plate tectonic accreationary models to actual in field land forms. Students who actively participated in the field trip did well on the following exam questions. During field trips there are students who attend without engaging. In this case, I can say with accuracy that the two students who performed unsatisfactory were not engaged during the discussion on the field trip. Prior to the trip I discussed the formations, accreationary tectonic setting and geologic development responsible for emplacement of the current landscape of Crystal Cove State Park.
GEOL G120	cSLO 8	Spring 2016	Discussion of Plate Tectonics and the formation of mountains was introduced within the first two weeks of the semester. I then related climate to topography such as the Himalayan Mountains China-India and Andes of western South America. Tectonic forces built these mountains, which impacted climate and ecological development. We then introduced fossils and mass extinctions of oceanic species during the Ordovician 475 million years ago. Trilobites went extinct due to plate movement of the North American Plate and the African Plate. The collision uplifted the Appalachian Mountain ranges destroying the habitat of the Trilobites and changed climate in the back basin (Ohio River Valley, which resulted in a different ecosystem.Students were required to respond to essay questions on the exam and use the concepts of plate tectonics, paleoclimatology and ecosystem.All three are interrelated and relating concepts of mountain building events as a cause and effect relationship builds a concrete base for understanding changes paleoclimatology and plate tectonics.

DATA PLANNING

Table 5. cSLOs assessed and corresponding Data Planning.

*Denotes historical cSLOs.

Course Name	cSLO	Semester Assessed	cSLO Data Planning
GEOL G105	cSLO 4	Spring 2017	A different SLO testing strategy that I will probably start next semester is using geologic application questions to test ability to define relevance of geologic principles. Possible topics might include: how local ocean currents affect dispersion of treated urban sewage that is dumped in the ocean, impact of seawater desalination on local biological systems, seawater intrusion into municipal aquifers. Practical applications of geology hold the interest of students.
GEOL G105	cSLO 5	Fall 2015	This is a concept that is rare and applies to California Geology. Text books do not provide detailed information on the relationship of strike- slip faults to anticline and syncline folds. Additional in class discussions of unique California faults resulting in formation of structures such as anticlines and syncline folds must be stressed and repeated during in-class lectures. In general, text books address geologic structures such as anticline and syncline fold structures based on applied forces such as compression. In most places around the world this works well, however California's geologic setting is unique. After we establish the relationship of folds to faults we then need tie in oil as a trapped liquid found in anticline folds due to tectonic pressure. Other regions such as Texas and Oklahoma oil are found in syncline folds due to a lack of tectonic pressure and gravity becomes the important force. Greater cause and effects of natural relationships needs to be stressed. If we tie together geologic phenomena and causes and affects this will provide students wiith a greater in depth understanding of concepts. We also should stress that California is a unique geological setting.
GEOL G105	cSLO 5	Fall 2017	I have discovered that students fail to take sufficient notes. Then often rely on pictures taken from cell phones. When I write test reviews on the board, many students will not write the review on paper and simply rely on a photo image on the phone as a study tool. I conducted an experiment this semester where I wrote out important concepts on the board. I then instructed the students to write the concepts on a sheet of paper and turn it in as a quiz I had several student obtain scores such a 3, 4, 6 and 7 out of ten, simply because they failed to copy the answer down on a piece of paper. I need to encourage students to take better notes and may require a notebook for class
GEOL G110	cSLO 2	Fall 2015	Considerable review and different approaches to fossil fuels . The correct to non-correct responses were all or nothing on the exam. This Indicates that the information was well understood by some students and not understood at all by others. We need to improve the understanding of key essential points of resources and tie them together in a manner that students can understand the information and relate to it. Correct responses compared known oil reserves and recently discovered natural gas and oil deposits of the United States. This is an area that requires improvement. The test question targeted possibility of substitution of Saudi Arabian oil for fracking natural gas and oil of North America. This was the area where students had the lowest level of understanding and some were unaware of the geographical location of countries such as Saudi Arabia. The question required knowledge of known reserves, recently discoveries in North America, and other countries such as Brazil who have substituted fracked oil and gas as a domestic resource. A large number of students were at first unaware that substitute fuels are being used. Where we can improve student success is to relate energy resources to current consumers and students. Part of the geology curriculum as a SLO requires the relationship of resources to use in society. A large portion of students are unaware of the energy resources and where they originate, which seems to be a common theme. Students are aware of Seismic fracking a process of energy extraction may provide an alternative to dependency of foreign Mid-Eastern oil. However they seem to be more aware of the ecological hazards of fracking due to media exposure and activism from Hollywood actors. In class we need to tie in natural

Course Name	cSLO	Semester Assessed	cSLO Data Planning
			resources to consumer products and that consumer product demand is the catalyst for resource extraction. All resource use has cost and consequences.
GEOL G110	cSLO 3	Fall 2015	Increase the use of crystal form as a physical property of mineral identification. Purchase student crystal model sets and increase student exposure to this physical property of mineral identification. Attempt to steer students on a heavy reliance of color. Color is one of seven physical properties used to identify minerals. Students seem to rely on color and over-use this property. This results in incorrect mineral identification due to the lack of proper testing employing crystal form along with hardness ,luster, specific gravity , and special properties of minerals.
GEOL G110	cSLO 3	Fall 2016	Problem: We cannot have an open lab format where students may study mineral and rock samples over an extended time period. Exposure to mineral and rock samples occurs during lab time. I plan to construct a set of student mineral and rock kits that the students can check out in the STEM Center or overnight as a take home kit.
GEOL G110	cSLO 3	Summer 2017	The mineral identification lab that was administered is well supported by materials in the Math/Sci 117 classroom and the associated laboratory facilities, which include excellent mineral specimens and materials that are needed for testing(streak plates, magnets, hardness kits). Based on the outcome that demonstrates89% proficiency, no changes are necessary.
GEOL G110	cSLO 5	Fall 2016	Focus on aspects of geology where students seem to have lower success rates. Introduce various delivery techniques, actual examples and short text, illustrations and when appropriate videos. The introduction of more hands on illustrations in lecture my aid in student success.
GEOL G110	cSLO 5	Spring 2018	Applications of lecture and hands on activities are important. Students are introduced to material in lecture. They understand the concept of isotope ratios to warm and cold climate. Those concepts are greatly magnified with actual exercises. Planning additional in class activities with hands on learning has greater outcomes.
GEOL G110L	cSLO 1	Fall 2017	Applications of theories along with hands on experiments that involve students creating hypothesis, then physical growing crystals to test the various hypothesis and observing their work over an extended period of time reinforces theories and scientific explanations.
GEOL G120	cSLO 2	Spring 2018	Applications of lecture and hands on activities are important. Students are introduced to material in lecture. Construction of a poster board applies concepts to a visual large format illustration. When student actively construct the project they become a active part of the learning outcome outcomes.
GEOL G120	cSLO 5	Spring 2016	Reinforcement is an important component to student success. Field trips add to classroom lecture and power point presentations. Formations and the forces responsible are given a large magnitude when viewing the side of a mountain or geologic fault in the field. Scales and magnitude of mountain building forces are difficult to illustrate during a lecture. More field trips and greater importance on participation by students. I need to Illustrating that the content of these field trips will be covered on lecture exams.
GEOL G120	cSLO 8	Spring 2016	Reinforcement is an important component to student success. However taking it one step further and relating concepts mountain building caused by moving plates has the effect on climate, which then impacts the living ecosystem forcing evolution. Standalone concepts such as plate tectonics will be incorporated with mountain building, which impacts climate and then determines the ecological setting of a region. I plan to do greater linking utilizing cause and effect.