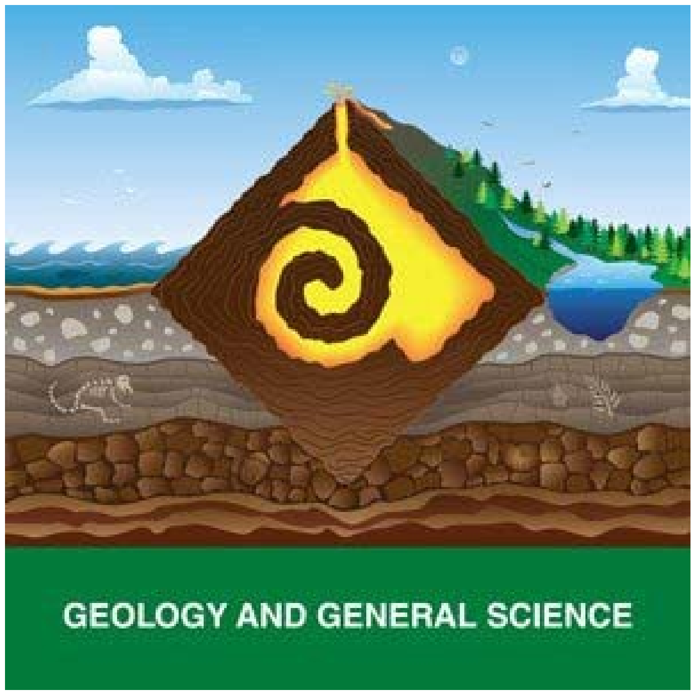
Geology and General Science Program Review

Portland Community College 2016



Prepared by:

Andy Hilt - SAC Chair

Melinda Hutson

Eriks Puris

2016 Geology and General Science Program Review

1. Program/Discipline Overview:

A. What are the educational goals or objectives of this program/discipline? How do these compare with national or professional program/discipline trends or guidelines? Have they changed since the last review, or are they expected to change in the next five years?

The Geology &General Science (G/GS) SAC spans a wide range of subject areas and is the second smallest LDC science SAC at the college with a campus wide FTE of 217.4 in 2014-2015. We are a growing SAC; our FTE has increased by over 100% since 2000-2001. When the senior full time instructor began teaching at PCC in fall 1996 2 full time instructors and 1 part time instructor were sufficient to teach all the G & GS courses at PCC, in spring 2010 2 full time instructors and 14 part time instructors were required to teach all the G & GS courses at PCC, and now in 2016 3 full time instructors and 15 part time instructors are needed to teach our SAC courses. The percentage of course sections taught by full time faculty fell from 70% in 1996 to 20% in 2010, and is currently between 22 and 25%, despite the addition of a third faculty member after the previous program review.

We cover the largest disciplinary range of any science SAC; the subjects we teach include astronomy, geology, meteorology, and oceanography, and are listed under two course codes (G for Geology and GS for General Science). Our courses support several different groups of students. We offer access to science for students who feel that biology is too squishy and that physics and chemistry are too sterile and abstract. We help prepare LDC students for transfer to four year institutions and for further study in the fields of astronomy, geology, meteorology and oceanography. We support the CTE programs in Aviation Science, Emergency Management and GIS. Finally, our courses promote student engagement in sustainability, sense of place and lifelong learning.

However, geology and general science have an undeserved reputation as being a "soft" science, and somehow not as important as the other sciences. Yet the opposite is true. Many of the major policy issues today involve a component of geology or general science. This has been recognized by the National Science Foundation (NSF) in their document entitled *Earth Science Literacy* (http://www.earthscienceliteracy.org/es_literacy_6may10_.pdf), which states "We need governments that are earth science literate".

The American Geosciences Institute published a document in 2012 outlining eight critical needs for the 21st century (http://www.agiweb.org/gap/criticalneeds/CriticalNeeds2012.pdf). These eight needs are:

1. Energy and Climate Change: Ensure reliable energy supplies in an increasingly carbon-constrained world
2. Water: Provide sufficient supplies of water
3. Oceans, Atmosphere, and Space: Sustain ocean, atmosphere, and space resources
4. Waste Treatment and Disposal: Manage waste to maintain a healthy environment
5. Natural Hazards: Mitigate risk and build resilience from natural and human-made hazards
6. Infrastructure Modernization: Improve and build needed infrastructure that couples with and uses earth resources while integrating new technologies

7. Raw Materials: Ensure reliable supplies of raw materials
8. Geoscience Workforce and Education: Inform the public and train the geosciences workforce to understand earth processes and address these critical needs

The G/GS courses cover all of these needs and focus on personal responsibility in areas where human intervention has either exacerbated or mitigated damage and/or deaths related to a geologic process such as landslides, floods or earthquakes. We feel that it is particularly important that students have some exposure to the geosciences. As the AGI publication makes apparent, too few students are graduating from high school with any exposure to a G/GS course – see their figure 8B below.

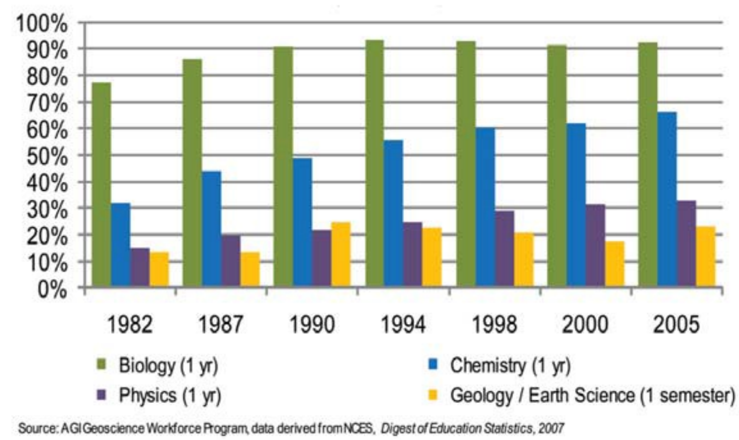


Figure 8B: Data collected by the American Geosciences Institute shows the very low percentage of public high school students taking just one semester of a geoscience class versus other science classes.

19

Additionally, by getting students interested in field research and independent study, we hope to entice students to major in a G/GS field. The geotechnical and environmental fields are expanding today, while the workforce is shrinking. As the AGI publication's figure 8A makes clear, there are far fewer students receiving geoscience Bachelor's or Master's degrees today than in the past. These are the students who join the geotechnical workforce. Doctoral students go on to join colleges and universities as teachers and researchers.

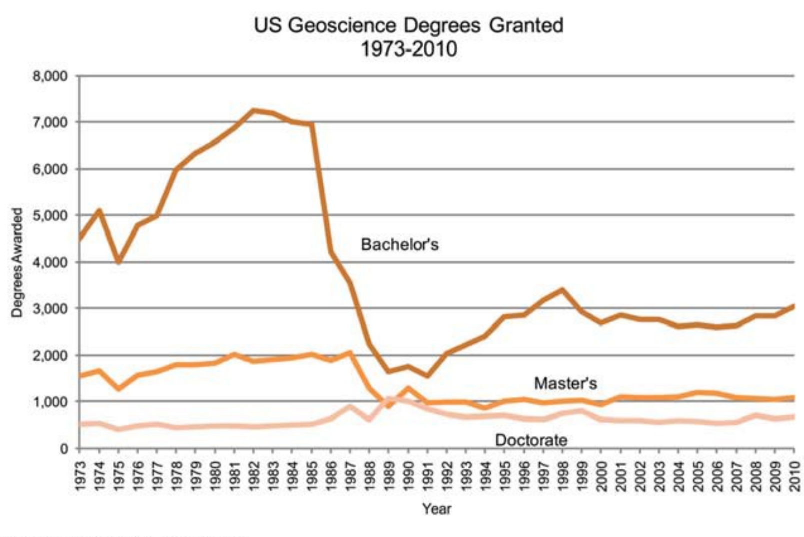


Figure 8A: Data collected by the American Geosciences Institute shows the decline in geoscience degrees granted. The public and private sectors face a dilemma of an aging workforce and a limited number of skilled new workers educated in the U.S. to fill the growing gaps.

The goals of the G/GS SAC as stated in our 2010 program review were as follows:

1. Make science and scientific thinking accessible to students.
2. Introduce students to the scientific understanding of their physical environment (earth, atmosphere, ocean and space).
3. Engage students in active learning by requiring students to make their own observations and measurements in the classroom and field, use this information to develop and test concepts and then apply this learning to problem solving.
4. Promote scientific literacy and application of scientific information to solving societal issues related to the earth sciences (e.g. geologic hazards, earth resources, and global change).
5. Develop a sense of place for the lands, waters, and skies of the Pacific Northwest.
6. Prepare students for future success in college level courses.

Since the 2010 program review, there has been a national-level recognition that students need to develop higher-order critical thinking skills. There is a new emphasis on metacognition, as well as on visualization skills. At this point there are new plans for changes in the goals of our discipline. Future avenues of development for our SAC include: 1) placing a greater effort on the exploration and use of learner based pedagogies (active learning); 2) integrating the earth systems approach to earth science into the curriculum (stressing the connectedness of the different areas); 3) stressing how understanding past global change provides a context for achieving future sustainability; 4) exploring the role of and interaction between humanity and the earth sciences ; and 5) incorporating STEM relevant curriculum to enhance students opportunities in future science careers.

B. Briefly describe changes that were made <u>as a result of</u> SAC recommendations and/or administrative responses from the last program review.

In our previous program review (May 28, 2010), the G/GS SAC made seven recommendations, each of which will be discussed below along with the corresponding administrative response.

i. Increase full time faculty.

The G/GS SAC recommended hiring four additional faculty, with expertise in meteorology, oceanography, geology and distance learning. At the time, there were only two full-time faculty members in our SAC, with our classes being offered at four campuses (Sylvania, Rock Creek, Cascade, Southeast Center). We discussed in the previous review the need for faculty with expertise in meteorology, oceanography, and distance learning, all of which are notable weaknesses of the current full-time faculty. We also noted that roughly 75-80% of our classes were being taught by part-time instructors.

The administrative response was “instructor positions will be considered along with other requests … as we prepare the next biennial budget. Make recommendations to your respective campus dean.”

Since the previous program review, one additional FT position became available at Southeast, and was filled by Eriks Puris, who transferred from Rock Creek. Andy Hilt was hired to fill the position at Rock

Creek. Despite this, we still have roughly 75-80% of our classes taught by part-time instructors. Additionally, all three FT instructors' expertise is in "hard rock" geology, leaving us with a lack of expertise in meteorology, oceanography, and distance learning.

We have been fortunate in having excellent part-time instructors who made long-term commitments to teaching at PCC, but this is beginning to change. Part-time instructor Frank Granshaw was one of our two experts in DL and also in meteorology and oceanography. He set up the weather station at Sylvania and helped create our DL classes. He retired last year and is no longer available to help with updating and maintaining either the weather station or the DL classes. Part-time instructor Karen Carroll took on the responsibility of organizing and setting up the G/GS program at Cascade. While she was there, we had good communication between all four campuses. Karen left PCC to take a full-time position at Umpqua Community College. Since then, we have had limited communication between part-time instructors at Cascade and the rest of the SAC. This has been driven home recently, as information about facilities and equipment at Cascade has not been readily available for this program review. Other long-term part-time faculty are approaching retirement age. In the past few years we have begun to have difficulty at Sylvania hiring qualified part-time instructors (Department Chair Patty Maazouz, personal communication).

Six years after our previous review, the recommendation regarding the need to increase full-time faculty remains as relevant as ever.

ii. Additional Facilities and Equipment

In our previous program review, we recommended building an additional lab room at Sylvania, building and stocking new lab rooms at Cascade and Southeast, and establishing a district-wide network of web accessible weather stations.

The administrative response was "please work with your campus division deans … as they develop plans for their respective bond projects" and "submit a budget proposal to your SAC administrator ... who will work with the other Campus Division Deans and DOIs to identify funding options".

Since the previous program review, a new lab space for G/GS classes has been created at Southeast. Additional space has been created at Cascade, but is poorly documented due to lack of a FT faculty at that campus. The pre-existing lab room at Sylvania was initially not included in the most recent bond remodel. Thanks to efforts by Division Dean Dieterich Steinmetz and Department Chair Patty Maazouz, the G/GS lab room (ST 317) was included in the remodel. However, due to lack of funds, the remodel was relatively minimal. Changes were made to wiring and lighting, and the blackboard was replaced with a white board, with storage shelves behind the white board. Otherwise, classroom seating remains unchanged, with re-use of pre-existing tables , chairs, and cabinetry. A survey of part-time faculty at Sylvania elicited a large number of complaints about the existing lab room post-remodel. The G/GS program at Sylvania has also grown too large to be contained within the one lab room, and classes are being taught in Physics or Chemistry labs.

iii. Additional Lab Tech Support

Previously, we recommended "the hiring of lab tech support with an earth science background to support our discipline at both Sylvania and Rock Creek" with the possibility of hiring "part time lab techs that also teach as part-time instructors".

The administrative response was "Please consult with Drs. Dieterich Steinmetz and Margie Fyfield about this recommendation."

Andy Hilt at Rock Creek reported on a short term experience at his campus. Mariah Tillman was hired to provide tech support for science classes at Rock Creek. She had a geology background and was able to assist instructors in things such as pulling rocks for an "igneous" test. It appears that her primary duties were to support Chemistry and Physics, with support for G/GS as time permitted. She was told that she was spending too much time on G/GS, has since left Rock Creek, and has not been replaced. With the large number of classes and numerous part-time faculty, both Sylvania and Rock Creek still badly need earth science literate tech support. At Sylvania, not only do G/GS instructors use the rock and mineral samples, but they are accessed and used in Chemistry classes as well. A frequent problem is that samples are either not put away at all, or are put away in incorrect bins. Each year, FT faculty Melinda Hutson and PT faculty Gretchen Gebhardt have had to spend days sorting and reorganizing samples. The Sylvania campus has also purchased equipment (such as a stream table, and groundwater demonstration model) which are currently used by only one or two faculty, as many of the part-time faculty do not know how to set up or maintain the equipment. A key goal of the G/GS SAC is to have students do experiments and/or obtain data in class rather than the worksheets common to many lab manuals. This requires equipment and more importantly lab tech support.

iv. Institutionalize Field Based Learning

We previously recommended that field based learning become more fully incorporated into our curriculum, with "more support for individual instructors who take their classes on field trips", teaching more field trip classes, and the incorporation of field based learning to our CCOGs.

The administrative response was "incorporating field-based learning outcomes into the CCOGs of all G&GS courses will require the SAC to work with the Curriculum Office." There was no mention of support for instructors or teaching more field trip classes.

Since 2010, the G/GS SAC has worked to encourage field based learning. We revised our CCOGs to include a field-based outcome. As discussed in sections 3Bi and 3E, we have created new G/GS field classes, have purchased equipment to support field based learning, and have encouraged part-time faculty to include a field experience in their courses. Currently about 50% of our lecture/lab classes include a field trip component. All of this has been without significant support from the college. Part-time instructors often volunteer their time on a weekend day for a field trip. They use their own vehicles to meet students in the field as there are no vans for most field trips. Additionally, there are difficulties planning longer field trips associated with the field trip classes as fees paid by students for a field trip go into a general fund rather than to the department/division that has to pay the expenses.

v. Improve Student Access to Research Experience

Our previous recommendation was to create G and GS independent study courses to give students additional opportunities to pursue research while still attending PCC.

The administrative response was "An independent Study (IS) courses is being offered in Biology" and "One challenge will be for your respective Campus Division Deans to determine how Faculty who teach IS courses are compensated and how it will be calculated toward an instructor's teaching/workload".

As noted in section 3E, the G/GS SAC created independent study courses in 2012/2013. We do not yet have any mechanism in place to determine how faculty who teach these courses are compensated. Additionally, we have worked to outsource undergraduate research experiences, by promoting REUs to our students (UCORE—a 5 year NSF funded program entitled Undergraduate Catalytic Outreach and Research Experiences at University of Oregon; IDES – Increasing Diversity in Earth Sciences at Oregon State University; and NASA Space Grant). We received very positive feedback from our students who participated in these REUs.

vi. Update and Revise Course Descriptions and CCOGs

One of our recommendations was to amend the course descriptions for lab courses to clearly indicate that these courses included lab credit. We also recommended revising CCOGs to meet state wide outcomes for general education, and to include field based learning outcomes.

The administrative response was "The DOIs encourage you to work with Curriculum Committee and Curriculum Office to modify your course descriptions to include lab credit. Incorporating field-based learning outcomes into your courses will need to be brought to the Curriculum Committee."

As noted in section 3E, the G/GS SAC has been active in updating and maintaining our CCOGs. They have been revised in 2010/2011, 2011/2012, and 2012/2013 to make all of the changes we recommended and more.

viii. Change the name of the SAC

Over the years, the SAC name had become the Physical Science, Geology and General Science SAC, causing confusion with the Physical Sciences Department, Chemistry, and Physics. We recommended shortening it to Geology and General Science.

The administrative response was "The DOIs support changing the name of the SAC to Geology & General Science (G/GS). It is our understanding the SAC is now listed in the Program Review section under G/GS".

The SAC took steps to ensure that this change was made throughout PCC.

2. Outcomes and Assessment: Reflect on learning outcomes and assessment, teaching methodologies, and content in order to improve the quality of teaching, learning, and student success.

A. Course-Level Outcomes: The College has an expectation that course outcomes, as listed in the CCOG, are both assessable and assessed, with the intent that SACs will collaborate to develop a shared vision for course-level learning outcomes.

i. What is the SAC process for review of course outcomes in your CCOGs to ensure they are assessable?

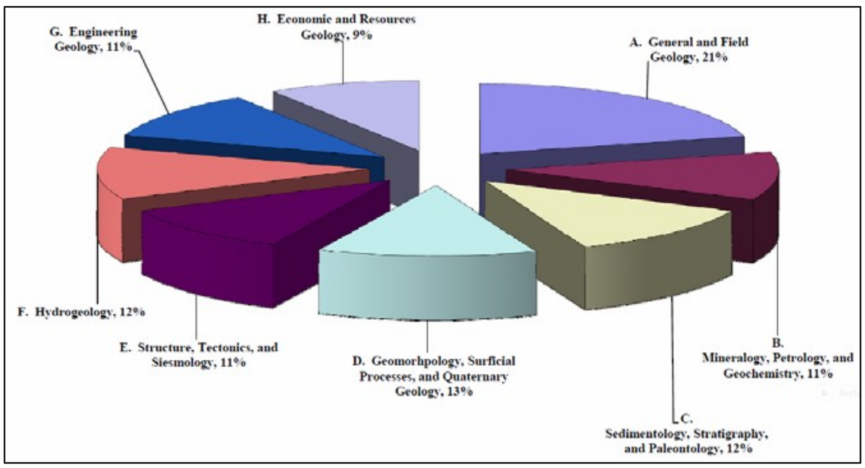
The SAC created relatively broad course outcomes under PCC supervision as part of a change from CCGs to CCOGs. The current CCOGs are updated versions, and are given in Appendix 1. The CCOGs were updated to meet changing state regulations, and a list of topics to be covered was added at the request of part-time instructors who found the content descriptions of the new CCOGs to be insufficiently detailed to give them meaningful guidance in designing their courses.

Currently, full time and part time faculty develop their own curriculum based on the SAC CCOG's. The CCOG's provide the framework for concepts to be covered, skills to be developed, and also provide potential outcome assessment strategies included in the CCOG's as follows: "The instructor will choose from the following methods of assessment: exams, quizzes, lab exercises, written reports, oral reports, group projects, class participation, homework assignments, and field trips. The instructor shall detail the methods to be used to the students at the beginning of the class". Each independent instructor plans his or her own course utilizing the assessment methods they feel are most suited for the students attending their courses. Each instructor makes sure that the CCOG's are being met based on the assessments chosen. Allowing our instructors to have autonomy regarding the implementation and assessment of the CCOG's has proven to be beneficial for our SAC as a whole, because instructors feel empowered to implement lessons that highlight personal strengths, experiences, and interests. By and large, students have demonstrated an overall positive response to this arrangement. However, this has made it difficult to close the loop on course level assessment at the SAC level. The three full time instructors have discussed the concept of developing a common laboratory or field experience between campuses for each of our courses. A common curricular experience would ensure assessability of the CCOG's across the college and develop more collaboration among faculty teaching common courses. The three full timers agree that this would strengthen the SAC regarding course outcomes and accessibility.

In addition to broad outcomes, our CCOGs include lists of topics to be covered. There are no well-established national earth science course guidelines; despite this, there is a large degree of uniformity between academic departments teaching earth science. This uniformity exists both in the courses taught and in the content of individual courses. One example of this is the introductory level G 201 Physical Geology (Internal Processes), G 202 Physical Geology (Surface Processes) and G 203 Historical Geology sequence which is taught at PCC and most Oregon Universities and Community Colleges. Figure

2.1 below shows a blueprint of concepts covered by the National Association of State Boards of Geology (ASBOG) licensing examination (http://www.asbog.net/). This exam (Fundamentals of Geology Examination) has been developed on a nationwide basis, and is required for professional licensure in the state of Oregon. The concepts covered in this blueprint are expected of professionally certified geologists at the time that they complete a bachelor degree in geology (FG Exam). While our G 201, G 202, & G 203 courses are not expected to cover all of the concepts thoroughly, they are designed to introduce potential geoscience majors to the majority of them. G 201 covers components of domains A, B, E, and H. G 202 covers components of domains A, C, D, F, and G. G 203 covers components of domains A, B, C, and E. After completing all three courses, geoscience majors have been introduced to all eight domains covered by the ASBOG examination.

Figure 2.1 – ASBOG Task Analysis 2015 FG Examination Blueprint – Domain Percentages



The G/GS SAC has monitored and will continue to monitor future developments in the field of earth science literacy, including changes to the ASBOG examination process as we continue to modify our course guidelines.

ii. Identify and give examples of changes made in instruction to improve students' attainment of course outcomes, or outcomes of requisite course sequences (such as are found in in MTH, WR, ESOL, BI, CH, etc.) that were made as a result of assessment of student learning.

The evolution of our CCOGs will undoubtedly continue; the past adoption of the long gestating statewide general education outcomes is a case in point. The SAC would like to stress that in addition to SAC level changes to course content, evolution of course content also occurs at the course level specifically by individual instructors. An aspect of this evolution especially germane to G/GS courses is the gaining of local knowledge. Mt. St. Helens is less than two hours from Portland. Field trips to the southern flank of this local volcano allow our students to better understand volcanic features and volcanic hazards. In addition, Eriks Puris has established an overnight field course to the northern flank of Mt. St. Helens. Students stay at the Mount St. Helens Science and Learning Center during this trip. While there, they hear from local scientists and experts firsthand. All of our courses are greatly enriched by including local examples like Mt. St. Helens, and as an instructor's knowledge of our region increases, the local examples become a much more important part of their teaching. ***After interpreting the results of last year's internal processes assessment, both Eriks Puris and Andy Hilt added a stop on their fall field trip to Mt. St. Helens.*** It was clear that students were in need of a local example of a lahar deposit to fully understand the impacts of this particular volcanic hazard. Eriks incorporated a stop at Lahar Viewpoint and Andy added a stop at Speelya Bay so that students could analyze lahar deposits as part of this experience. Local examples like these can be used to introduce ideas and concepts, as case studies, test cases for the application of concepts and topics for student research. This local knowledge can have a strong seasonal aspect; the ocean currents, storms and stars of the fall are not the same as those of the spring. The SAC will continue to grow by adding more local examples into our curriculum.

The three full time faculty discussed having a long term goal (within the next ten years) of revising the CCOG's to ensure that the course level goals and the college outcomes are aligned and not just specific to the course content alone (see section 8Ai). We acknowledge that we struggle to close the loop on assessment, specifically in addressing curricular changes based on course results for each term, as well as on an annual basis. At this point, we are not 100% confident about exactly how to make content/course level changes based on the data that we collect, but we are all anxious to explore this issue further in the hopes of improving course level curriculum for all of our instructors. We are open to advice on how to improve the tie between college level initiatives, course outcomes, and curriculum.

B. Addressing College Core Outcomes

i. Update the Core Outcomes Mapping Matrix. http://www.pcc.edu/resources/academic/core-outcomes/mapping-index.html For each course, choose the appropriate Mapping Level Indicator (0-4) to match **faculty expectations for the Core Outcomes for students who have successfully completed the course.** (You can copy from the website and paste into either a Word or Excel document to do this update, and provide as an Appendix.)

An updated copy of the core outcomes mapping matrix for the G/GS SAC is provided in Appendix 2. Most of the changes were relatively minor. For example, the mapping level for community and environmental responsibility for G 202 was raised from a 2 to a 4, as this class deals with issues such as groundwater pollution, human involvement in landslides and their mitigation, problems or shoreline erosion, and climate change.

C. For Lower Division Collegiate (Transfer) and Developmental Education Disciplines: Assessment of College Core Outcomes

i. Reflecting on the last five years of assessment, provide a brief summary of one or two of your best assessment projects, highlighting efforts made to improve students' attainment of the Core Outcomes.

The strategies used to determine how well students are meeting core outcomes changed over the last few years. PCC had just begun to assess its core outcomes at the time of our last program review. Our first assessment was of critical thinking and was evaluated via a research paper and field project on mass wasting. Our assessment was cited by the Learning Assessment Council as "exemplary" in Fall 2010. Over the next two years, the mass wasting project was expanded to assess all six core outcomes (see Appendices 3 and 4). While this assessment vehicle proved to be successful in assessing the six PCC core outcomes, the SAC had limited success in implementing this method consistently due to the high workloads associated with this project. While we no longer use this as a SAC assessment, some of the G/GS faculty continue to use the mass wasting project as part of their individual course assessment.

In response to feedback from disgruntled part-time faculty, many of whom refused to participate in the assessment, the SAC created a more tractable assessment vehicle which began four years ago. The SAC has developed an annual assessment strategy that utilizes a pre-test and post-test survey in order to determine student achievement of core outcomes across the SAC. These pre-test and post-test surveys have been conducted in Survey Monkey, and currently are utilized to assess all students taking G 148, G 201, G 202, G 207, G 208, and GS 106 during the winter term at all PCC campuses. Two separate surveys have been developed. The first survey covers content related to internal processes, and the second survey was developed to cover surface processes. Questions contained in both surveys cover all of the PCC core outcomes, with the exception of Cultural Awareness. The breakdown of relevant questions and their correlation to the PCC core outcomes are shown in table 2.1 below.

Table 2.1 – G/GS SAC Question Correlation to PCC Core Outcomes

PCC Core Outcomes	Relevant Questions: GS 106, G 148, G 201, G 207, & G 208	Relevant Questions: G 202
CO1. Communication	5, 6, 11, & 12	11 & 12
CO2. Community and Environmental Responsibility	8, 12, 17, & 18	18 & 19
CO3. Critical Thinking and Problem Solving	13, 14, 15, 16, & 17	13, 15, 16, & 17
CO4. Cultural Awareness		
CO5. Professional Competence	5, 6, 7, 8, 9, 10, & 18	5, 6, 7, 8, 9, 10, & 14
CO6. Self-Reflection	3 & 4	3 & 4

Two separate pre- and post-test surveys have been developed so far and are included in Appendices 5 and 6. The first survey addresses topics related to internal processes and therefore has been utilized in GS 106, G 201, G 207, G 208 for three years because those are courses that cover internal processes as part of the curriculum. This same survey has been administered in G 148 this year because this brand new course also includes internal processes as part of the curriculum. Two of the three full time instructors (Andy Hilt and Eriks Puris) do not teach any of the assessed courses during the winter term when the pre- and post-test surveys have been administered. For this reason, a second test related to surficial processes was prepared in 2015 so that the two full time instructors could collect pre- and post-test data relevant to the G 202 course taught by both of them during the winter term. These new core outcome surveys have proven to be much more user friendly amongst the faculty teaching relevant courses during the winter term during the last three years. The data obtained has provided a more thorough perspective of student growth pertaining to the PCC core outcomes since the initiation of this new method, however, minimal changes to classroom curriculum and teaching strategies have taken place since that time. We have not had a significant amount of time to truly interpret the results of our annual assessment plan, since it has only been utilized for three years so far. The SAC will continue to modify the surveys, collect data, and interpret annual results. This new core assessment vehicle will eventually result in modifications to teaching at the classroom level throughout the SAC, once an appropriate level of data has been collected. In addition, core outcomes are covered by individual instructors using a variety of methods some of which are highlighted below. The change in our core outcome assessment vehicle has earned our SAC two awards for exemplary assessment of student learning. These awards from 2014 and 2015 are included in Appendix 7.

ii. Do you have evidence that the changes made were effective (by having reassessed the same outcome)? If so, please describe briefly.

The results of our post-test surveys from 2014 and 2015 are shown in table 2.2 below. Our SAC set the benchmark for attainment as 60% of students should correctly answer the post-test questions associated with the outcome for Communication, Community and Environmental Responsibility, Critical Thinking and Problem Solving, as well as Professional Competence. Our survey also incorporated two questions (3 & 4) from both surveys that assessed the core outcome of self-reflection. These questions asked specifically if their interest in geology has increased, and if they view their understanding of geology as a contribution to their world view and how they make decisions as a citizen. The values for student responses in table 2.2 below represent students who “agreed or strongly agreed” with these two self-reflection questions.

Table 2.2 – G/GS Survey Results for the SAC PCC Core Outcomes

PCC Core Outcomes	2014 Results	2015 Results	Change in Results
CO1. Communication	57.3%	57.3%	0.0%
CO2. Community and Environmental Responsibility	25.8%	48.5%	+22.7%
CO3. Critical Thinking and Problem Solving	42.8%	53.0%	+7.2%
CO4. Cultural Awareness	Not Evaluated	Not Evaluated	Not Evaluated
CO5. Professional Competence	38.6%	49.6%	+11.0%
CO6. Self-Reflection	70.4%	81.0%	+10.6%

We did not attain our desired benchmark for any of the outcomes, with the exception of self-reflection. We did, however, increase in four of the five categories ranging from +7.2% to +22.7% as shown in the table. The only category that did not result in a positive change from 2014 to 2015 was communication, which simply remained the same for both years. The SAC feels that these increasing results demonstrate that changes made to the assessment method and possibly curriculum were indeed effective.

iii. Evaluate your SAC's assessment cycle processes. What have you learned to improve your assessment practices and strategies?

The main thing learned by the SAC is to make sure that the assessment process is user friendly for all members of the SAC. The original mass wasting project was a great way to assess the core outcomes, but it did not fit into the curriculum of many SAC courses, and was a significant undertaking for our instructors. Many instructors did not buy into the original project, and therefore we received minimal data on which to make future assessment decisions. The pre- and post-test method seems to be much more amenable to our entire department. At a bare minimum, instructors can choose to dedicate just 20 minutes at the beginning of the term and 20 more at the end for a total of 40 minutes of annual commitment to the SAC assessment process. They may also choose to have students record their answers to both tests in hard copy format. Andy Hilt at Rock Creek began requiring that his students do this, and then took an additional ten minutes on the last day of class to have the students determine their pre-test score and compare it to their post-test score. Students get an opportunity to see clear evidence of achievement in the course, are able to review concepts covered during the term, and review for the final exam. The instructor gets immediate feedback regarding the growth of the class over the term.

We have learned that specific details within any given question can be somewhat misleading to the students. During these first few years, we have made several minor modifications to our questions to be sure that students are being assessed on what they know, not how well they read a particular question or interpret a specific type of data. One prime example of this was a newly prepared three dimensional diagram which replaced a topographic map on the volcanic hazard questions (13 through 18 on the Internal Processes pre-test and post-test survey). Our intention was to assess critical thinking and problem solving and not topographic map reading skills. By changing the format of the illustrations and data set provided, we have been able to more adequately determine what students know about volcanic hazards. Most recently, we noticed that a significant number of students were choosing the wrong choice when answering question 13 on the G 202 pre- and post-test assessment. The question requires students to interpret contour lines and the rule of V's when contour lines cross a river valley. Many students were choosing choice D (350 feet) when the correct answer is choice C (330 feet). When we took a closer look at the question, we realized that they were reading the elevation of point X when the question asks about the elevation of stream X as it leaves the map. We are planning to change the question to make it more interpretable so that they are not misled by the wording, or drawing as it is set up. These are a couple examples of simple improvements that can and have been made to our annual assessment vehicle to make it more useful.

iv. Are there any Core Outcomes that are particularly challenging for your SAC to assess? If yes, please identify and explain.

Our pre- and post-test assessment method includes questions that cover all of the PCC core outcomes except for Cultural Awareness. Our SAC has found this core outcome to be particularly challenging to incorporate into our annual assessment plan. The former assessment method (Mass Wasting Project) did an excellent job of incorporating cultural awareness. Several instructors have continued to use this research project and find it to be a useful tool for interpreting cultural awareness of the student participants. At this point, it would be very difficult to include an additional PCC core outcome into our pre-test and post-test assessment plan, and therefore we do not intend to do so. The current method is pretty efficient, as it covers 83% of the college core outcomes in some way. Regarding the purpose of the annual assessment plan, our SAC's understanding is that all students at PCC should encounter all six core outcomes during their time at PCC. We do not feel that it is necessary to make major changes to a plan that covers 83% of the outcomes as they are described, when many other courses that students will take may be more suitable to incorporating this core outcome into their curriculum and annual assessment plan. In addition, each of our instructors has a unique background and differing ethnic cultural heritage. We have three instructors that grew up in foreign countries, and one who has 100% Latvian heritage. We have more female instructors than men, and have a significant range of ages within our department. Each instructor brings their own interests, history, and heritage into their teaching methods and classroom curriculum. For this reason, cultural awareness is not completely removed from the G/GS SAC, and it is demonstrated in some regard for every class that we teach.

3. Other Curricular Issues

A. Which of your courses are offered in a Distance Learning modality (online, hybrid, interactive television, etc.), and what is the proportion of on-campus and online? For courses offered both via DL and on-campus, are there differences in student success? (Contact the Office of Institutional Effectiveness, either Laura Massey or Rob Vergun, for course-level data). If so, how are you addressing or how will you address these differences? What significant revelations, concerns, or questions arise in the area of DL delivery?

The table provided in Appendix 10, lists all of the courses offered by the G/GS SAC. Most of our courses are offered face-to-face (F2F) only. For those classes which are offered via DL, the fraction of DL versus F2F depends on whether or not the course has a laboratory section. For the four GS classes (GS 106, 107, 108, 109) only a small fraction (10-15%) of the sections taught were via DL, while for G 207, 208, 209 (which lack laboratory sections), a fairly large fraction (75-80%) of the sections taught were via DL (2014/2015 data).

For these classes, the SAC does not see any difference in student success. For the 2014/2015 academic year, 81-89% of students taking the four GS courses (GS 106, 107, 108, 109) as F2F at the Sylvania campus passed their courses, as compared to 78-90% of students taking an on-line lecture with the lab at the Sylvania campus. For G 207, G 208, and G 209, the on-line courses are taught only through the Rock Creek campus. Due to their popularity, no F2F versions of these classes have been taught at the Rock Creek campus since the 2011/2012 academic year. In that year (2011/2012), the pass rates for students were also comparable, with 64-82% of students passing the F2F course versus 78-81% of the students passing the DL course. Note that the data table used by the SAC only gives pass rates for F2F courses at the same campus as the DL host.

The SAC has a number of concerns and revelations regarding DL delivery of our courses.

i. Geology is a field-based science. All of our instructors can come up with an example of students “getting” a difficult concept after being out in the field. The angular unconformity at Shore Acres near Coos Bay Oregon is one of these examples. Images were in the textbook, and had been discussed in class. One student who was struggling with the material took the G 160 field trip course and visited Shore Acres. Standing on a cliff looking across at the angular unconformity, he turned to his instructor with a big smile and said, “I finally understand what you’ve been talking about”. Images on screen lack both scale and the third dimension. Without these, some of the geologic structures studied appear as abstract art to many of our students. It is impossible to adequately give a field experience on- line. DL is not appropriate for any of our field classes (G 160, 161, G 200 series).

	
The black rock in this image is a sheet of basalt extending away from the observed. This is obvious with stereoscopic vision.	An angular unconformity near Coos Bay Oregon. The rocks were deposited flat, tilted by tectonic activity, and eroded flat. New flat deposits are on top of the erosional surface.

ii. Most of the "lecture" classes taught by the G/GS SAC include a laboratory component. Students may be working with rock and mineral samples, large quadrangle maps, stream tables, groundwater flow tubes, or three-dimensional structural models. The SAC created hybrid versions (lecture DL/lab F2F) of some of our GS classes (GS 106, GS 108, and GS 109). Several years ago, one of our part-time faculty (Frank Granshaw, no longer at PCC) developed a fully on-line version of GS 106. The lab component of this course included a kit with samples, and was considered unsuccessful by the course developer, who recommended returning to a hybrid version. The SAC returned to a hybrid version of GS 106, and the hybrid versions of these three GS classes have proved sustainable through changes of instructors.

iii. While DL is without a doubt an important part of the future, the G/GS SAC is unprepared for it. The current state of DL G/GS classes were developed by four part-time instructors. Two of those instructors no longer work for PCC. Adjunct faculty should not be relied on to create and maintain DL classes. The G/GS SAC has three full-time instructors working to maintain a program at four campuses. None of these three faculty members have the expertise or experience needed to develop and maintain DL classes. A new full time faculty position, with a focus on DL, is required for any further expansion. This requires additional support from the administration.

iv. The biggest revelation is that on-line courses by and large are simply correspondence courses with a message board attached. One of the SAC members naively thought that a DL course would be interactive, requiring students to work through a series of on-line exercises that would allow the student to change and explore multiple variables. Student responses would then prompt the teaching program to choose the next module based on the student's responses to the previous module, fitting the on-line experience to the needs of the individual student. Instead, the faculty member discovered DL courses to be mainly text-based correspondence courses. Videos and static content (images and text) are presented for a student to watch and read. Usually the student takes quizzes, with multiple-choice questions dominating most of the on-line science classes we've examined. The promise of DL courses has yet to be realized. Bill Gates' comment in his 2010 annual letter that "We should focus on having at least one great course online for each subject rather than lots of mediocre courses" dovetails with the opinions of the G/GS SAC (Bill Gates Annual Letter 2010 http://www.gatesfoundation.org/Who-We-Are/Resources-and-Media/Annual-Letters-List/Annual-Letter-2010#OnlineLearning).

B. Has the SAC made any curricular changes as a result of exploring/adopting educational initiatives (e.g., Community-Based Learning, Internationalization of the Curriculum, Inquiry-Based Learning, Honors, etc.)? If so, please describe.

i. Field Based Learning

The G/GS SAC has made an effort to incorporate Field Based Learning. Field Based Learning is recommended by numerous Geoscience entities, including the American Geological Institute and the National Association of Geoscience Teachers. Almquist, et al. (2011) discusses the importance of spatial thinking to STEM (Science, Technology, Engineering, and Math) disciplines, and notes that "geoscientists in particular must have excellent visualization skills". They go on to discuss specific visualization skills used in geology, and discuss how Field Based Learning can improve visualization skills in students. Mogk (2011) expands on this, discussing how Field Based Learning improves metacognition, and spatial abilities while helping to transfer concepts to long-term memory by engaging multiple senses at the same time.

(Heather Almquist, George Stanley, Lisa Blank, Marc Hendrix, Megan Rosenblatt, Seymour Hanfling, and Jeffrey Crews (*2011*) An Integrated Field-Based Approach to Building Teachers' Geoscience Skills. Journal of Geoscience Education: February 2011, Vol. 59, No. 1, pp. 31-40.
doi: http://dx.doi.org/10.5408/1.3543926

Dave Mogk (2012). Teaching geoscience methods in the field. InTeGrate essay:
http://serc.carleton.edu/integrate/workshops/methods2012/essays/mogk.html)

Since the last program review, the G/GS SAC has obtained equipment (e.g., pocket weather stations, water sampling equipment, GPS) to enable students to make their own measurements in a field setting. We have encouraged faculty to incorporate a field component into their classes, with a stress on active learning. Most (>50%) of our "lecture" courses include a field component. Student feedback has been positive, and includes statements about how much the field component helped with understanding or learning the material.

Among the major challenges to incorporating Field Based Learning is transportation to and from field sites, and scheduling trips associated with classes. Without vans available to transport students, instructors rely on students being able to provide their own transportation, which excludes some students who rely on alternative transportation from many of the field locations. Even with transportation, it is not always possible to fit a field trip into a three hour laboratory period, and many students have families or jobs that prevent them from meeting outside of class for a one day field trip.

ii. Internationalization

The PCC website (http://www.pcc.edu/resources/academic/internationalization/) defines internationalization as "A process that transforms the curriculum and the campus community by advancing intercultural competence, deepening comparative knowledge of peoples and cultures, and encouraging global learning as essential to understanding the complexity of issues in the world today." The web site also has the vision of "Portland Community College will be a leader in offering learning opportunities to our diverse community in a rich international context, using an integrated approach to advance intercultural competence, a deep, comparative knowledge of peoples and cultures, and a recognition of the impact of global issues on the lives of the members of our community."

The G/GS SAC has not made a deliberate effort to include internationalization in our classes, but we find that most of our instructors do wind up having an international context to some of our topics. Most of our classes discuss geologic hazards and their effects on communities in other countries, as well as possible effects on a global scale. As an example, earthquakes are discussed in G 201, G 148, GS 106, G 207 and G 209. Recent discussions have included comparing the Cascadia subduction zone with the 2004 Sumatra quake and the 2011 Japan quake. Comparisons include the problems of communicating tsunami warnings across multiple nations (Sumatra) versus one nation (Japan), cultural histories of tsunami (Japan had ancient markers warning against building on ground lower than the markers), emphasis on tourists versus natives as victims of Sumatra, etc. Discussions of the 2010 Haiti earthquake and the 2015 Nepal earthquake have included topics such as international aid, short-term aid, and long-term problems. Haiti, in particular, has not recovered well from the 2010 earthquake. There have been several cholera epidemics from poor sanitation following the earthquake, and as of 2015, there was still a large population of displaced people, with many worse off than before the earthquake (http://time.com/3662225/haiti-earthquake-five-year-after/).

A number of our courses (GS 106, GS 107, GS 109, G 184, G 202, and G 203 in particular) include aspects of global climate change and may discuss policy issues related to climate change, as well as the impact of climate change on global communities. All of our classes have the potential to include an international component if the instructor chooses to include one. For example, GS 107 (Astronomy), which at first glance seems far removed from international politics, can include discussions of the missions which are currently returning data on the solar system and universe. In many cases, the missions involve the space agencies of other countries, such as the European Space Agency (ESA), Japan's space agency (JAXA), the French space agency (CNES), and the Russian and Chinese space agencies. To date, our only samples returned from an asteroid are from a JAXA mission.

iii. Inquiry-Based Learning

Inquiry is a key component of the scientific method. Our SAC does not have a specific program of inquiry-based learning, and yet all of our classes use inquiry-based learning at some level. As an example, below are the outcomes from the Course Content Outcome Guide (CCOG) for GS 106:

1. Use an understanding of the rock cycle, plate tectonics and surface processes to explain how the earth's surface wears away and is renewed.

2. Use an understanding of geologic dating methods and the interpretation of geologic deposits to explain how geologists reconstruct the history of the earth.

3. Access earth science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of geologic processes identifying areas of congruence and discrepancy.

4. Make field and laboratory based observations and measurements of earth materials and landscapes, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of geologic processes identifying areas of congruence and discrepancy.

5. Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the hazards and risks posed by geologic processes both to themselves and society as a whole, evaluate the efficacy of possible ethically robust responses to these risks, and effectively communicate the results of this analysis to their peers.

6. Assess the contributions of geology to our evolving understanding of global change and sustainability while placing the development of geology in its historical and cultural context.

The CCOGs for our other classes are similar. Notice particularly, outcomes 3, 4, 5, all of which are describing ways of using inquiry-based learning. Outcome 6 refers to internationalization in addition to inquiry.

C. Are there any courses in the program offered as Dual Credit at area High Schools? If so, describe how the SAC develops and maintains relationships with the HS faculty in support of quality instruction.

GS 108 (General Science: Oceanography) is taught by two instructors at Lake Oswego High School. An instructor at Aloha High School has requested to teach Physical Geology (G 201 and G 202) and Historical Geology (G 203). The G/GS SAC met with the latter instructor at a DL facilitated meeting last year. Neither of the two Lake Oswego instructors made the meeting. Despite this meeting, there has been minimal institutional facilitation of HS-2YC communication and interaction. Maintaining relationships and supporting the HS faculty has been largely left to individual efforts by G/GS faculty.

D. Please describe the use of Course Evaluations by the SAC. Have you developed SAC-specific questions? Has the information you have received been of use at the course/program/discipline level?

G/GS faculty use the Course Evaluations to improve their individual classes. The G/GS SAC did develop SAC specific questions in 2013. Then when we asked how the SAC was supposed to access the results of these questions, we were told that there was no mechanism in place to do so. Individual instructors could access their evaluations, but not the SAC. So, the SAC has chosen not to incorporate SAC specific questions into further Course Evaluations, and has not used any of this information at the course/program/discipline level.

E. Identify and explain any other significant curricular changes that have been made since the last review.

2014/2015

- Created two new courses (G 148 Volcanoes and Earthquakes; G 184 Global Climate Change) in response to a need for entry level classes with lower Math prerequisites than our other courses. Both courses are on the general education list, have MTH 20 as a prerequisite and are taught at other Oregon community colleges.

2013/2014

- Exploded G 200D Geology Field Studies to G 200D Geology Field Studies, G 200E Geology Field Studies: Mount St. Helens, G 200F Geology Field Studies: Pacific Northwest Coast, G 200G Geology Field Studies: Columbia River Gorge. This change enables students to take the one credit field trip class to different locations and receive credit and financial aid. These classes transfer to Portland State University, which has separate 1 credit field trip classes to Mount St. Helens, the Pacific Northwest Coast, and the Columbia River Gorge.

2012/2103

- Created new independent study courses: G 298A Geology Independent Study (1 credit), G 298B Geology Independent Study (2 credits) and G 298C Geology Independent Study (4 credits). Creation of these courses opened the door to an in-house research experience for credit for G/GS students.
- Exploded G 200 Field Studies (2 credit) to G 200A Geology Field Studies (2 credits), G 200B Geology Field Studies (4 credits), G 200C Geology Field Studies (6 credits), and G 200D Geology Field Studies (1 credit). The 2, 4, and 6 credit versions were created to match BI 200A, BI 200B, BI 200C so that they could be taught together as a combined biology/geology field experience. The 1 credit G 200D was created to match the 1 credit G 200 course at Portland State University. G 200 is a requirement for the PSU Earth Science Major.

- Cleaned up outcome #4 for courses on general education list (G 201, G 202, G 203, G 207, G 208, G 209, GS 106, GS 107, GS 108, GS 109) by changing “make field based observations and measurements” to “make field and laboratory based observations and measurements”. This more closely aligns the outcomes to practice.
- Renamed course G 161 from Geology: Malheur Region to Geology: Great Basin/Cascades due to difficulties obtaining permits to access the Malheur area.

2011/2012

- Changed MTH prerequisites for GS 106, GS 107, GS 108, GS 109, G 207, G 2 08, G 209 from MTH 20 to MTH 65 and for G 201, G 202, G 203 from MTH 20 to MTH 95. Stronger math preparation increases student success in these courses.
- Revised course descriptions of lab courses to specifically include the mention of lab sections. The SAC had been getting several requests per year from transfer students requesting that we verify that these courses did indeed include a lab component.

2010/2011

- Revised outcomes of all general education courses (G 201, G 202, G 203, G 207, G 208, G 209, GS 106, GS 107, GS 108, and GS 109) to meet revised statewide outcomes for general education science courses and to stress the importance of field based learning.

4. Needs of Students and the Community

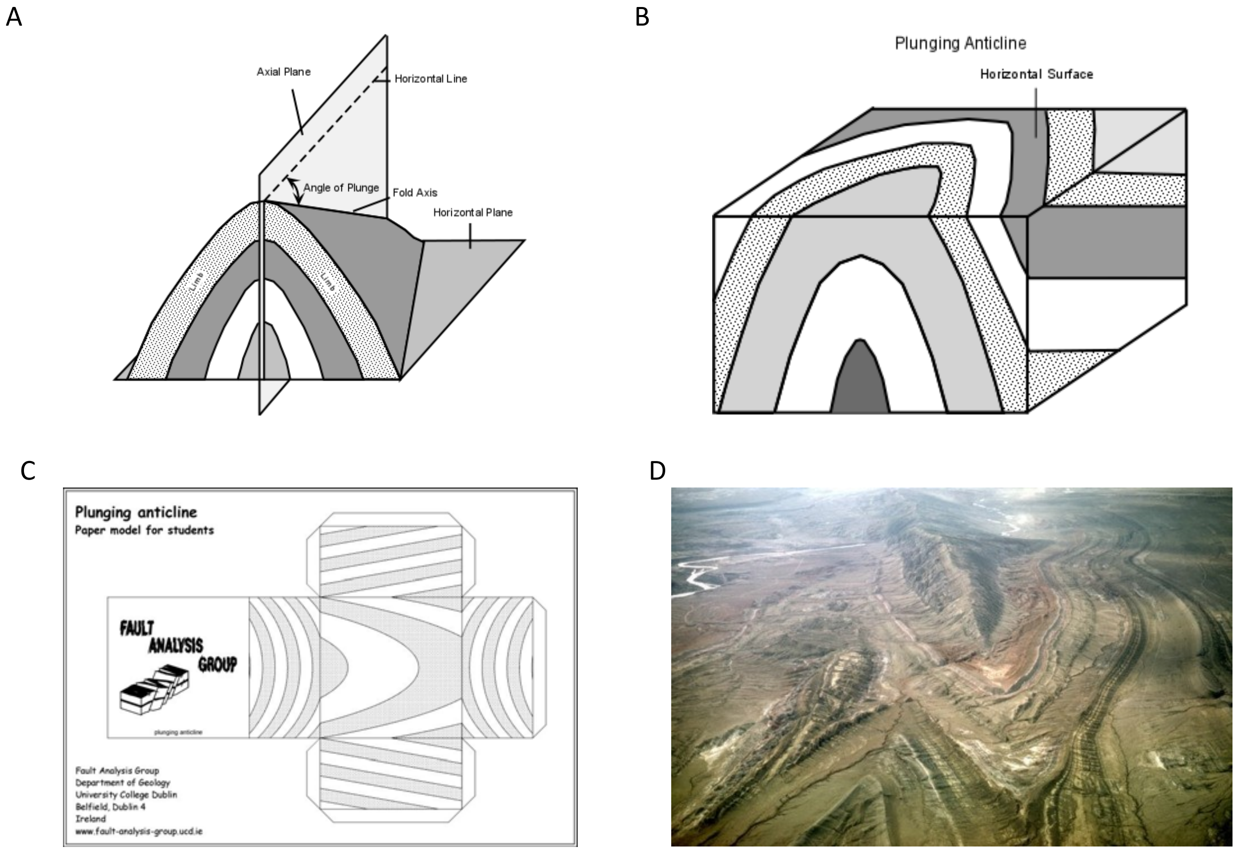
A. Have there been any notable changes in instruction due to changes in the student populations served?

There have not been any significant changes in the student populations served by G/GS classes at Rock Creek or Sylvania. We have not heard of any significant changes at Cascade (which lacks a full-time G/GS faculty). However, our subject area has expanded to the Southeast since the last program review. Southeast students include a larger proportion of underserved students than the other campuses. We found that students wanting to take G/GS classes for their science requirement often didn’t meet the MTH 65 prerequisite for the GS classes, much less the MTH 95 prerequisite for the G classes. We also saw that some of these students were overwhelmed by the amount of information in the GS courses, particularly GS 106 and GS 107, each of which covers a compressed and simplified version of a year-long sequence of classes (GS 106 covers material from G 201, G 202, and G 203; GS 107 covers material from PHY 121, PHY 122, and PHY123). As a result, we created two new on-ramp courses (G 148 and G 184), each of which has a lower math prerequisite (MTH 25) and focuses on one topic (volcanoes and earthquakes; global climate change) rather than being a survey course.

B. What strategies are used within the program/discipline to facilitate success for students with disabilities? What does the SAC see as particularly challenging in serving these students?

For the most part, we make the accommodations requested for students by Disability Services, including making lecture materials available before class, testing in a distraction free site with extended time, etc. We've had sign language interpreters in our classes when needed. Our two major challenges have been with students with vision problems and with mobility issues.

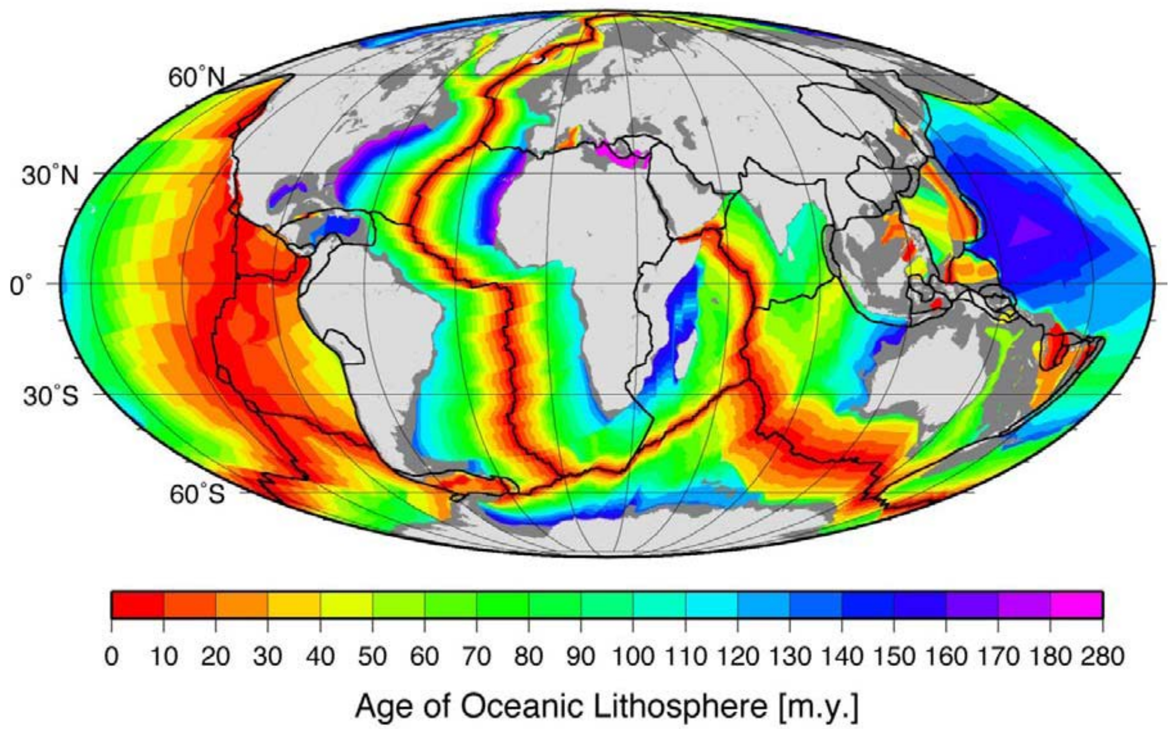
As mentioned in the section on Field-Based Learning, the geosciences require excellent visualization skills. Not only do student need to extrapolate from a two dimensional diagram into the third dimension, but maps and diagrams are all color-coded, which can be a problem for students with color blindness, as well as other visual impairments. Two examples of common problems are given below.



Above: Example of a plunging anticline – layers of rock are folded into an upside down U-shape. Then the folded rocks are tipped so as to no longer be horizontal. A shows the geometry of the fold. B shows a "block diagram" which has a map view of the fold after erosion to produce a flat surface, and two of the sides that project underground. C is a cut out pattern for the same block diagram—students can cut out and fold to create a flat block, so as to see top and sides. D is a photograph of a plunging anticline in reality.

One of our SAC members, part-time instructor Gretchen Gebhardt, teaches a hybrid section of GS 106, and has received curriculum development funds to provide solutions for disabled students in her course. As part of this work, Gretchen has been looking into creating three-dimensional models and/or manipulatives with differently-textured layers for visually impaired students to handle.

A separate problem is that all of the geologic maps use boxes with colors to color code rock units. Below is an image of the age of the ocean floor, with the ages given via color coding. We've had students with color blindness be unable to use these maps and diagrams. After a discussion with Disabled Services, our solution was to pair the student up with another student who could interpret the colors ("this color on the map here corresponds to this color on the scale").



Finally, there is the challenge of taking mobility-impaired students out into the field. We have worked with students to arrange for alternative field experiences using local urban locations that have better access. In one instance in a G 202 class, a wheelchair-bound student identified stream features in a small stream on the property where he lived.

C. Has feedback from students, community groups, transfer institutions, business, industry or government been used to make curriculum or instructional changes? If so, please describe (if this has not been addressed elsewhere in this document).

As mentioned above, G 148 and G 184 were created in response to feedback from students requesting introductory level classes focused on one topic and with a lower math prerequisite.

The G 298 independent study sequence was created in part as a response to feedback from a student who was receiving biology independent study credit to work at the Rice Northwest Museum of Rocks and Minerals, because there was no option for receiving geology credit at that time. We currently have five students enrolled in one of the G 298 courses.

Also as mentioned above, the G 200 classes were exploded specifically to match the field trip classes required at Portland State University for their geoscience majors.

5. Faculty: Reflect on the composition, qualifications and development of the faculty

Provide information on:

A. How the faculty composition reflects the diversity and cultural competency goals of the institution.

Currently there are three full-time and 16 part-time faculty distributed across the district in the following way: at Sylvania there is one full-time faculty and six part time faculty; at Rock Creek there is one full-time faculty and five part-time faculty; at Cascade there are three part-time faculty; and at Southeast there is one full-time faculty and two part-time faculty. One senior full-time faculty member is Melinda Hutson who has been teaching at PCC for 20 years, has a Ph.D. in Planetary Science and has disciplinary strengths in geology, geochemistry, geophysics, and meteoritics (the study of meteorites). The second senior full-time faculty member is Eriks Puris who has been teaching at PCC for 12 years, has a Ph.D. in Geophysical Sciences and has disciplinary strengths in geology and geochemistry. The junior full-time faculty member is Andy Hilt who has been teaching at PCC for four years, has a Masters degree in Geophysics with strengths in Seismic Hazards and Hydrogeology. Andy also brings 14 years of high school teaching experience along with five years of professional experience working as a Hydrogeologist for a civil engineering firm to our SAC.

The part-time faculty bring a broad range of experience and expertise to our SAC. While many are just beginning their careers at PCC many have been here for over ten years and one has been teaching at PCC for over 25 years. Our part-time faculty is dominated by instructors with training and work experience in geology. Many of our instructors bring valuable earth science related work experience to their roles as instructors including Kyle Dittmer (meteorology), Talal Abdulkareem (petroleum geology), Gretchen Gebhardt (park ranger) and Ken Sutton (computer systems).

The G/GS SAC has a better gender balance at present than most college/university geology programs, including PSU (tenure-track faculty there consist of 8 male professors, including the two most recent hires, and 2 female professors; the three fixed-term faculty are all male). Here at PCC, the three full-time faculty consist of two male instructors and one female instructor. The sixteen part-time faculty consist of 7 male instructors and 9 female instructors. Overall our staff consists of a relatively balanced 9 males and 10 females. Three of our part-time instructors are also originally from other countries (Indonesia, Iraq and Austria), giving our SAC a slight international flavor. Based on the ethnicity of the current student body in geology at PSU, OSU, and UO, the pool of geoscientists from which we can pull part-time faculty will remain dominantly of European ancestry.

In Winter term 2016, 36 sections (includes both lecture and lab combined) of G/GS classes were offered. Each of the three full time faculty taught three of these sections or 25% of the total courses offered. At one point in time, PCC had a stated goal of having 70% of its classes taught by full-time faculty, which would require an additional 5 full-time G/GS faculty (which isn't realistic). The SAC would benefit strongly from having one additional full-time faculty based at the Cascade campus, where all of our classes are currently taught by part-time instructors. We are more likely to see ethnically-diverse candidates from a nation-wide search for a full-time faculty than from the local population of geologists who apply for part-time positions.

B. Changes the SAC has made to instructor qualifications since the last review and the reason for the changes. (Current Instructor Qualifications at: http://www.pcc.edu/resources/academic/instructor-qualifications/index.html)

During the last program review the G&GS SAC discovered that the change in G&GS instructor qualifications approved at their fall 2008 SAC meeting to remove the demonstrated competence qualification (BS in field plus "reasonable background") at the bequest of the administration had not made it to the academic resources webpage. This led to a slight reworking of the wording and the addition of a provisional approval qualification for the G courses. The revised qualifications were approved in May of 2011.

In January 2014 Dean Lighthart asked the SAC to reexamine the demonstrated competence qualification as she was having trouble finding candidates who met instructor qualifications for GS 109 Physical Science (Meteorology) and GS 108 Physical Science (Oceanography) and furthermore that the "times were changing" and the administration was looking more favorably towards and even encouraging the re-inclusion of a demonstrated competence qualification (this probably had something to do with an increased push for dual credit courses but the SAC didn't realize that at the time). The SAC did reexamine the qualifications for GS courses and developed a separate set of demonstrated qualification for each course: GS 106 Physical Science (Geology), GS 107 Physical Science (Astronomy), GS 108 Physical Science (Oceanography) and GS 109 Physical Science (Meteorology). The new demonstrated competence qualification for each of these courses requires a BS in the subject area plus "demonstrated professional competency" supported by a minimum of 3 years of "documented full time equivalent experience" in the subject area OR a BS in a related subject area plus "demonstrated professional competency" supported by a minimum of 5 years of "documented full time equivalent experience" in the subject area. The revised instructor qualifications were approved in September 2014.

C. How the professional development activities of the faculty contributed to the strength of the program/discipline? If such activities have resulted in instructional or curricular changes, please describe.

Our faculty have been involved in a wide variety of activities that strengthen teaching and learning in our courses.

Beginning is 2010 the Geology and General Science SAC was active in PCC's partnership with the IDES (Increasing Diversity in the Earth Sciences) program out of OSU identifying potential students for this summer research/mentoring/internship program. Each year for the four years of this program several PCC geology students participated in this program many of which have continued on to pursue advanced degrees in geology. A notable example is Heather Herinckx who as a returning student with a family and children decided to delay applying to IDES for one year so that she could improve her pre-college level math skills. She did successfully apply, got an internship at DOGAMI (Oregon Department of Geology and Mineral Industries), finished a BS in geology at PSU, is co-author on a DOGAMI geologic map (Open File Report O-15-04), is pursuing a MS in geology at PSU and reports that she likes calculus. Heather's story clearly illustrates the transformative potential of mentored research/internship experiences for students outside of the traditional STEM pipeline. Some of the IDES students have returned to PCC to share their stories with current PCC students.

The SAC has also collaborated with SAGE 2YC (Supporting and Advancing Geoscience in Two-year Colleges) program. In the summer of 2013 Frank Granshaw and Eriks Puris attended a national SAGE 2YC workshop of "Supporting Students Success in the Geoscience at Two-year Colleges" which stressed active learning, metacognition, and student research and workforce development. Attending this workshop promoted and furthered several curricular developments including: closer working relations with PSU which included holding a G 202 class meeting in the PSU geology department and PSU geology advising section at the SE STEM center, the development of a class research project on Radon in the Portland Basin, the development of urban geology labs at the Dharma Rain Center, student independent study projects researching the Boring Volcanics in Portland and the use of 3D printers to create relief maps of the local landscape as well as the increased adoption of active teaching techniques in the classroom. This experience further spawned two regional workshops, the first in the 2014 spring at the SE STEM Center led by Eriks Puris, Frank Granshaw and Daina Hardisty (MHCC) and the second in Albany OR at

Linn-Benton CC led by Deron Carter (Linn-Benton) and Eriks Puris. These local workshops were attended by regional 2YC faculty including several PCC faculty and introduced PCC faculty to teaching recourses which are being used in the classrooms today such as The IRIS (Incorporated Research Institutes for Seismology) earthquake resources and project InTegrate (Interdisciplinary Teaching about Earth for a Sustainable Future) modules. The stress placed on the success of all students in these workshops helped trigger a reassessment of student needs at PCC which led, in part, to the development of new "on-ramp" courses with low MTH prerequisites (MTH 20) which engage students by focusing on societal important issues (G 148 Volcanoes and Earthquakes & G 184 Global Climate Change).

The collaboration with SAGE 2YC will continue as Eriks Puris and Andy Hilt along with Daina Hardisty (Mount Hood Community College) have started to work on the 4 year SAGE 2YC Faculty as Change Agents project. The project's goal is to create change in geoscience teaching at classroom, institutional and regional levels by supporting student success, creating pathways and broadening participation. The first workshop of this exciting project was just completed in early April and this June administrators from PCC will join us at a workshop to develop our four year plans.

The SAC has received three Curriculum Development Grants in the past two years. Gretchen Gebhardt (part-time) received funds for modifying assignments and course materials to increase student accessibility (primarily those with impaired/low/no vision) for the hybrid GS 106. Sharon Delcambre (part-time) received funds to develop lecture and lab course materials for G 184. Melinda Hutson and Eriks Puris (both full-time) received funds to develop lecture and lab course materials for G 148. A new endeavor is to create open resource materials for G 148 Volcanoes and Volcanoes, which will be supported by an Open Oregon Revise/Remix grant. Collaborators on this project include Eriks Puris, Andy Hilt, Marjan Rotting, and Megan Scott.

Ongoing efforts include work with the Oregon Space Grant Consortium as the campus affiliates at the Rock Creek (Andy Hilt) and Southeast (Eriks Puris) campuses which gives PCC students at these campuses access to NASA community college scholarships. Several of our faculty attend the regional National Association of Geoscience Teachers (NAGT) meeting each year, and return with increased knowledge of local geology, images and rock samples that can be incorporated into course materials, and professional contacts that allow for continued development.

In January of 2016, Andy Hilt attended the 2nd Summit on the Future of Undergraduate Geoscience Education Department Heads at the University of Texas, Austin in the Jackson School of Geosciences. The workshop focused on several themes related to student retention and success at four year colleges and universities. There were several hundred college professors in attendance from four year institutions (4YC) representing almost every region of the United States. Twelve two year college (2YC) instructors also attended the meeting. In addition, there were representatives from the National Science Foundation, the American Geophysical Institute, Science Education Resource Center at Carleton College, Lamont-Doherty Earth Observatory, and many other relevant entities. Important topics discussed at the summit were presented in the following order:

1. Overview of results: 2014 Summit, Survey, Geoscience Employers Workshop

2. Integrating concepts/skills/competencies into curriculum & courses

3. Pedagogy, teaching concepts/skills/competencies effectively

4. Overview of results: barriers/solutions/rewards from 2014 Summit and Survey

5. Overcoming barriers, finding solutions, creating incentives and rewards

6. Recruitment and retention of underrepresented geoscience students & empowering transitions between 2YC and 4YC

Results of the 2014 survey showed that the vast majority of attendees felt that the development of a student's competencies, skills, and conceptual understanding were far more important than the content they would acquire by taking specific courses. Important concepts were ranked by the respondents and are as follows: Earth as a complex and dynamic system, Deep time, Climate change, Natural resources, Surface Processes, Earth materials, Earth structure, Natural hazards, and Hydrogeology. The CCOG's (See Appendix 1) for our SAC align quite nicely with the most important concepts highlighted by this list.

Respondents also ranked the importance of general science skills for students and eventual employees. The ranking of general science skills are as follows: Critical thinking and problem solving, Communication, Ability to access and integrate information from different sources, Understand scientific research methods, Quantitative skills and ability to apply them, and Work in interdisciplinary teams across cultures. Many of these general science skills correlate significantly with the G/GS course outcomes (see Appendix 1), as well as with some of our PCC Core outcomes as outlined in section 2.C.

Specific geoscience skills were ranked as well, the result of which were: Make natural world inferences and observations, Solve problems spatially and temporally, Work with uncertainty, Integrate data from different disciplines, Have strong field skills, Have strong computational skills, and Be technologically versatile. Many of these geoscience skills have been emphasized by our SAC as essential to student learning and continuation on to a 4 year program. One major example is the SAC's emphasis on Field-Based learning (see section 3Bi).

Part of the summit focused on pedagogical methods that emphasize competencies rather than content. These methods include: Independent study, Field trips, Field Camp, Small group discussions, Learning through practice, Collaborative learning, Reflection and refinement, Blended learning, Explore before learning, Team based projects, and Flipped classrooms. Many of these methods are utilized by faculty within the G/GS SAC. For example, part-time instructor Holly Oakes-Miller utilizes the flipped classroom method in her G courses. In another example, Eriks Puris has multiple students taking our new Independent Studies classes at Southeast Campus. Their work has led to the development of hands-on learning materials as some students are creating models on a 3D printer while working with the maker space group at PCC. Additionally, Ray Sweeten a geology major from Rock Creek worked on a fossil display with Dr. Lara Brown formerly with the Rice NW Museum of Rocks and Minerals. This opportunity proved to be beneficial to all parties involved as Ray worked towards his independent study credit and helped update a display that is still used today.

The summit proved that there are many barriers to effectively incorporate competency based pedagogical practices in the 2YC or 4YC classroom. Of course time and money are always an obstruction, but faculty attitudes also proved to be problematic. Many instructors at all levels are happy with their current teaching methodology, interested in conducting research, or are beginning to think about retirement. Our SAC has a diverse mix of instructors who vary in their academic background, ethnicity, gender, as well as age. Hopefully we can inspire our varied staff to work towards competency based learning. The result of this should help provide outstanding, affordable education, ignite a culture of innovation, transform the community through opportunity, lead in diversity, equity and inclusion, achieve sustainable excellence in all operations, and drive student success.

6. Facilities and Academic Support

A. Describe how classroom space, classroom technology, laboratory space, and equipment impact student success.

The overall perspective regarding classroom space, technology, lab space, and equipment was assessed by the SAC during the fall of 2015 via an extensive survey to all of the members of the. This results of this survey were utilized to determine the status and needs at each campus. Table 6.1 below summarizes these results based on the responses from 12 SAC members. The responses are ranked from 1-needs significant improvement to 5-excellent. Most of our instructors are satisfied with the lecture and lab rooms and lab equipment (the majority chose above average). However, none of the respondents chose excellent for the lab rooms (the only item in Table 6.1 for which “excellent” was not chosen). While the majority of respondents were also satisfied with lab tech support, available technology, and textbooks and lab manuals, 9-20% of instructors chose below average or needs significant improvement for these categories. The important thing to note about this data is that it is the overall perspective of our SAC (12 out of 18 instructors responded to our survey) college-wide. There is a significant level of inconsistency regarding our facilities, equipment, technology, and support from campus to campus. Specific details and the impact to student success on a campus by campus basis follow.

Table 6.1 – Results of the fall survey for the program review.

	1	2	3	4	5
Lecture Room (AV Equipment, size, screens, tables, chairs, white boards, etc.)	0%	0%	18%	64%	18%
Lab Room (Space, tables, chairs, electrical outlets, sinks, etc.)	0%	0%	27%	73%	0%
Lab Equipment (Quality, quantity, age, batteries, etc.)	0%	0%	27%	64%	9%
Lab Tech Support	0%	9%	27%	45%	18%
Technology (Vernier probes & data analyzers, computers, weather stations, etc.)	9%	9%	36%	36%	9%
Textbooks and Lab Manuals	10%	10%	20%	40%	20%

Rock Creek: Rock Creek currently has two separate rooms (236 and 234) mostly dedicated to the G/GS SAC. A general view of each room is shown in figures 6.1 and 6.2 below.

Figure 6.1 - Room 234

Figure 6.2 - Room 236

These rooms work well for the blended format that is currently used at Rock Creek. Based on course evaluations, students seem to enjoy the lab/lecture blended format, and have commented many times that a 3 hour course can really fly by when the classroom environment continuously switches between lecture, activities, discussion, and experimentation. Each room is designed to facilitate the needs of 24 students, but can hold up to 28 students each, based on the established fire code restrictions. From fall through spring, the majority of classes at Rock Creek are filling at the fire code level of 28 students. Survey results showed that some instructors would like more white board space and better lighting. Several feel that it would help greatly if the lights could be dimmed at varying levels in different portions of the room, especially for lectures and during astronomy demonstrations.

Both rooms contain samples, maps, globes, and other equipment needed to facilitate laboratory experiments, demonstrations, and activities with students. Most laboratory equipment, however, is currently stored in the backroom preparatory area, where we have five carts available to G/GS instructors to stockpile equipment necessary to implement experiments in the classroom. Instructors are expected to organize the equipment prior to a lab, and then return the equipment to its appropriate storage location upon completing the experiments. This method is workable, but highly inefficient and requires more preparatory work on the part of our instructors rather than our students, especially since we have no lab technician specifically dedicated to G/GS needs. The continuous addition of new lab equipment has increased the need for keeping a tight inventory and organized system of storage. Rock Creek is currently employing two casual workers for a total of 8 hours per week to assist in this process. Finding reliable, educated workers has proven to be a real problem over the last two years. Rock Creek would benefit significantly by hiring a full time lab technician to help inventory, organize, calibrate, order, and replace broken equipment. In addition, Andy Hilt would like to have upper cabinets installed across an entire wall in both rooms. These upper cabinets could be equipped with general science laboratory equipment that students could access directly. The addition of cabinets could empower students to take control of the set-up, implementation, and clean-up of their own laboratory equipment.

This change would not only decrease the work load for our instructors, but would address several of the themes outlined by the PCC strategic plan. Students required to set up and tear down equipment would ***drive student success*** by helping them to build technical skills for partnerships with business and industry where they are asked to perform without supervision.

Many of the G/GS labs use computers. At Rock Creek a computer room is attached to each of the classrooms. Room 236 shares 14 computers and a large laser printer with Chemistry. Room 234 shares only 8 computers with Physics. Each of the computer spaces is shown in Figures 6.3 and 6.4 below. The first six computers shown in Figure 6.3 are dedicated to Physics courses only, and therefore are not available to G/GS students.

Figure 6.3 – Computers assigned to Room 234

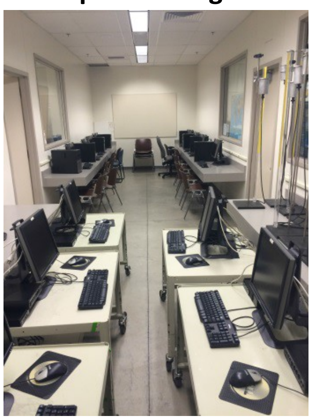
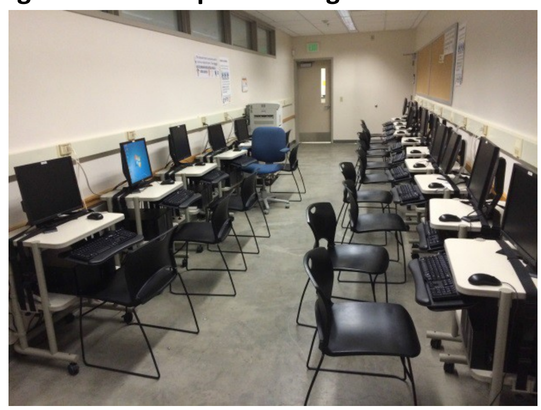


Figure 6.4 – Computers assigned to Room 236



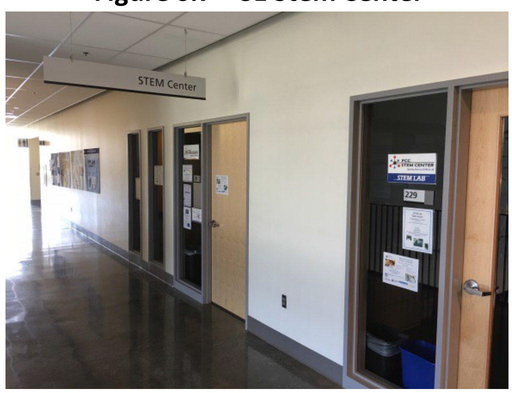
There is a distinct discrepancy between the two rooms in terms of computer availability. Part time instructor Chris Bailey is always assigned to Room 234, and utilizes computers often to access meteorology or oceanography software such as TSI Cyclones, and Weather Underground. The lack of computers in Room 234 restricts the flow of his lessons. Andy Hilt uses Geotours on Google Earth, Stellarium software for Astronomy, and other software packages as well. It is not nearly as challenging to utilize this technology in Room 236 because there are twice as many computers available for students. The big concern in Room 236 is the fact that chemistry may need computers at the same time that G/GS needs them, and there may come a time where two classes converge upon the 14 computers. This is limiting future growth in G/GS, chemistry, and physics. At one point, it was suggested that the computers be updated with netbooks, which do not have screens large enough to display the maps and charts used extensively by our program. Perhaps a cart with 15 toughbook computers to be shared between Room 236 and 234 would increase accessibility for the students in our courses. A sign-up sheet could be implemented to ensure maximum utilization of these computers. In addition, the toughbook style seems versatile and usable in field conditions. Certain courses could be enhanced significantly if students could conduct class in the outdoor environment where they could access PowerPoints, Excel, Word, and other software while conducting field investigations.

Southeast: Since the last program review, Southeast has seen the most significant growth transforming from a center to a comprehensive campus. In Winter 2012, the SCOM building opened with a dedicated G/GS lab room, storage space, and a STEM center (See figures 6.5, 6.6, and 6.7 below).

Figure 6.5 – SE G/GS Lab Room (SCOM 308)

Figure 6.6 – SE G/GS Storage Room

Figure 6.7 – SE Stem Center



That being said, not everything is perfect at Southeast. Instructors have discussed the unfortunate elongated design of the lab room with the white board and front of the room being permanently established along the short end of the rectangular shape (See Figure 6.5 above). This configuration puts some students at a significant distance from the screen and white board, resulting in a disadvantage when lecture and discussion is underway. In addition, the lectern blocks the white board from their viewing perspective and tables are high enough to prevent some students from seeing the lower sections of the white board. The lighting in the lab room does not allow for total darkness and causes problems during astronomy labs and demonstrations.

One positive consequence of having a new facility and campus is the availability of lab technicians. Instructors at Southeast are very pleased with their experiences working with two lab technicians (Steve and Avery) who have some time built into their schedule dedicated to assisting G/GS. This has proven to be a benefit to the program at Southeast. Full time instructor Eriks Puris has expressed his gratitude to

Steve and Avery for their assistance to our program. When Eriks was developing curriculum for the new Volcanoes and Earthquakes course (G 148), Avery began developing and constructing earthquake shaking tables for labs and demonstrations. He has been modifying his original prototype based on student experiences as they explained some of the strengths and pitfalls of the initial models. These earthquake shaking models are a work in progress, and Avery appears to be dedicated to the idea of eventually having an efficient working educational model that is highly efficient at helping students learn about the impacts of seismic activity on structures. In addition, he is working with Eriks to construct an augmented reality sandbox for students to use while learning about topographic maps in G 202. Once this is fully prototyped and curriculum developed at Southeast, it can be replicated at our other campuses.

Southeast has a portable cart with twelve laptop computers available to students. These computers are utilized by students to access Geotours on Google Earth Pro, Stellarium, and many other useful software packages. This system can be efficient, and is appreciated by the instructors teaching there, however, it comes with some logistical concerns with the movable storage box. Students have a difficult time returning the power plugs easily. This results in a disorganized, tangled mess that has the unfortunate consequence of some computers getting recharged and others being drained of energy. Additionally, it appears that some of the laptops are struggling with Google Earth Pro during classroom activities.

Sylvania: Currently, there are more instructors teaching G/GS at Sylvania than any other campus. The single existing laboratory room (ST 317) has not been significantly upgraded in the memory of anyone still working in the Physical Science Department at Sylvania (See Figures 6.8 and 6.9 below).

Figure 6.8 – SY G/GS Lab Room (ST 317)

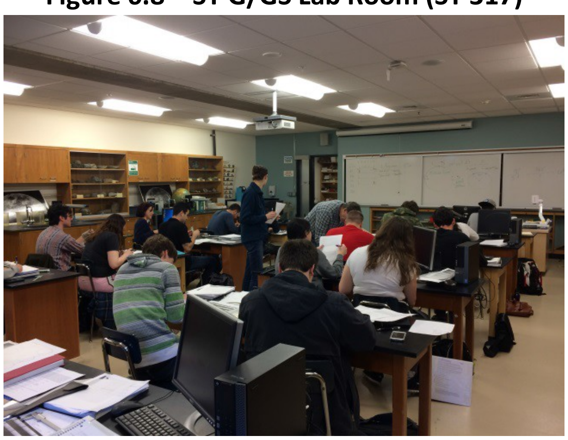


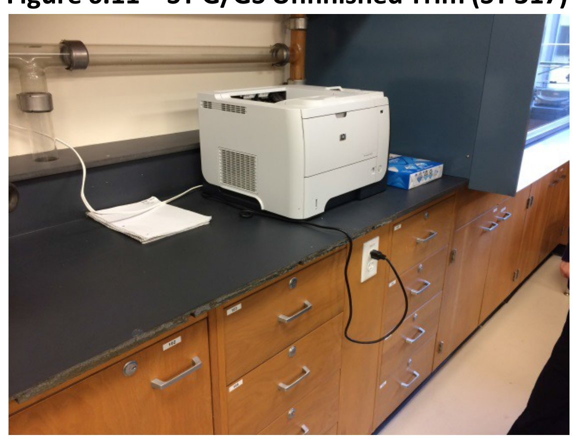
Figure 6.9 – SY G/GS Computers (ST 317)

There have been some minor alterations to improve lighting and add a whiteboard with additional storage, but major work is still needed. Given the room's space, instructors are content with tables in the room but chairs are becoming outdated, sink space is limited, the eye wash station is not functional, the walls lack appropriate space for maps, outlets are not located in reasonably accessible locations, and the cork board is old, stained, and torn. During previous bond measures, all of the Chemistry labs were remodeled and the Physics lab was expanded by incorporating the space from an adjacent classroom, yet G/GS has pretty much been ignored at Sylvania in regards to the G/GS dedicated facilities. While the lighting is better than it used to be, part time instructors would like to have the ability to dim the lights during demonstrations and labs. Several instructors have expressed their approval of lab technician Jacob, but have stated that he does not assist with the setup, organization, or tear down of G/GS materials for laboratory experiments. They are aware that this is not necessarily one of Jacob's job assignments, but this is a potential concern when these part time instructors can easily see that instructors from other disciplines have all materials prepared for them prior to labs and also returned upon completion. In addition to storage in ST317 (which can be difficult to access for instructors teaching in other rooms), storage space at Sylvania is limited to three very tightly packed shelving units adjacent to Room ST 317 as shown in Figure 6.10 below.

In past years, full-time faculty Melinda Hutson had received a number of comments about the inadequacies of Sylvania's lab room from both the department Chair and the division Dean. Both had examined the room and stated that although it met the letter of the law, it was not ADA friendly, with narrow access lanes. To fix this problem, protruding sections of the existing built-in cabinets were trimmed during the last remodel, leaving an unfinished edge in order to increase aisle space (See Figure 6.11 below). This retro-fit, along with mismatched floor patches, has left the room somewhat unsightly, and did not fix the issue of appropriate space for equipment or students. There is no way to improve this without physically expanding the room or significantly reducing the number of students (currently the standard 24 students in all G/GS lab sections) by removing tables.

Figure 6.10 – SY G/GS Storage Space

Figure 6.11 – SY G/GS Unfinished Trim (ST 317)



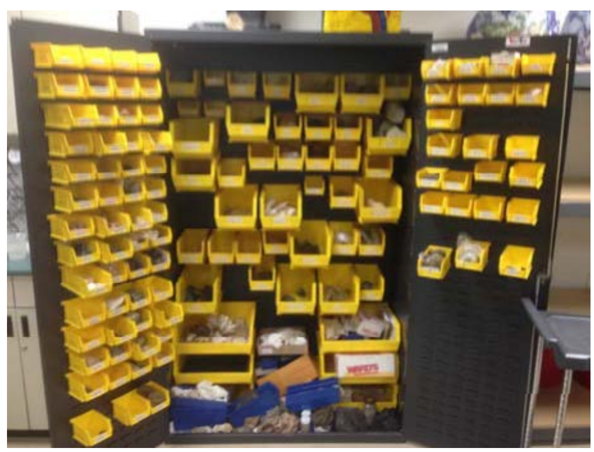
The number of G/GS courses at Sylvania are currently outstripping the capacity of the single laboratory room (ST 317) there dedicated to geology and general science. Sections of G/GS courses have spilled over into the adjacent Physics lab (ST 304). Each of the labs (Geology/General Science, Chemistry, and Physics) are designed to provide the space and equipment needed for experiments appropriate to their respective programs; for instance, the sinks are significantly smaller in the Physics lab than in the Geology/General Science Lab, which is a problem, particularly for oceanography and meteorology classes. Use of ST 304 by G/GS classes is also suboptimal in two significant ways: 1) it prevents the Physics program from expanding their lab based classes; and 2) materials for G/GS have to be transported from ST 317 to ST 305 for an individual class and then returned when the class is over. The laboratory space has become so tight that sections of GS 107 (Astronomy) have been taught, and are scheduled to be taught again in conventional classrooms, in separate buildings, far from any laboratory facilities and equipment that would enable students to make their own measurements and observations. Rather than obtaining and examining data in hands on experiments, students are provided with data to analyze, which is a huge deterrent to many of PCC's initiatives as outlined in the strategic plan. Lack of accessible lab rooms, storage, and materials does not ***provide students with outstanding, affordable education, drive student success, ignite a culture of innovation, achieve sustainable excellence in all operations, or help transform the community through opportunity***. Sylvania instructors deserve to teach in an environment that assists in accomplishing all of these PCC strategic plan goals for all of their students.

One final inadequacy at Sylvania is the lack of access to technology. Our students currently have access to only 6 computers, three of which are shown in Figure 6.9 above. This is not an adequate quantity of computers when trying to serve the needs of 24 students in a laboratory experience. Additionally, students are discouraged from printing by the availability of a single slow printer (see Figure. 6.11). To help ***drive student success*** at Sylvania, we will need to address the deficiency of access to technology for G/GS students by increasing the number of available computers. A cart with 7 additional laptops would enable students to work in groups of 2 during computer-based labs.

<u>*Cascade:*</u> There is one available space for G/GS classes at Cascade (Room 100 in Jackson Hall), but many other classes are scheduled in the same space (See Figure 6.12 below). Most of the G/GS lab equipment is stored in a few cabinets in the back of the classroom, and there is also a small storage room across the hall that is shared among multiple disciplines, but does host a few geology samples as shown in Figure 6.13 below.

6.12 – Room 100 in Jackson Hall at Cascade

6.13 – Storage at Cascade



Part time instructor Megan Scott has discussed the desired benefit of having the lab space available for 30 minutes before and after classes so that students could stay and finish labs, ask questions, and work with maps and samples more thoroughly. If they don't finish a lab, or would like an opportunity to practice skills or prepare for an upcoming assessment, they have no opportunity. This is because there is no space, time, or equipment available to them. There is limited equipment for G/GS classes and no permanent storage space for the limited materials there. A completely dedicated lab space with equipment and storage space is badly needed for the existing program, more so for an expanding one. Megan has also mentioned the need for more lab samples, models, demos, and visual aids as well. It is challenging to ask a part time instructor to develop strong laboratory experiences with students when there is limited access to laboratory equipment. Megan believes that the lab technicians who do the ordering of materials at Cascade are worried about finding new places to store any additional lab materials that they order due to the lack of space. They have ordered more shelves to go in the back of the classroom, but they have yet to arrive. One final note from instructors at Cascade is that the lighting could be improved upon in the G/GS classroom. It would be beneficial to be able to dim or turn off the front lights so that students can see the projection but still have the ability to write notes from their tables.

Cascade faces the significant problem of not having a full-time instructor to inventory, organize, and purchase laboratory materials. Megan has expressed her concern when it comes to ordering equipment. As a part time instructor, she does not feel comfortable ordering things or spending money from a budget that is not necessarily at her disposal. She is concerned with the impacts it may have on others within the department at Cascade. A permanent full time voice is badly needed to ensure the growth of the G/GS program at Cascade and therefore prevent limited opportunity for students attending G/GS classes at this campus.

The availability of computers is actually fairly good at Cascade. They have a rolling cart equipped with a class set of laptops that instructors are able to check out and use in Jackson Hall. Megan Scott has asked IT to have Google Earth downloaded onto them. She stated that they use computers fairly regularly in the G 201 and G 202 classes to work on Geotours. Sometimes there are issues with a computer running slowly, but restarting usually solves that issue. Of course there is always the detriment of decreased work time during class for the student who has checked out the malfunctioning computer. Megan would like to see more time allotted to the maintenance of the computers at Cascade to try and prevent lost class time and improve opportunity for students to succeed there while using these resources.

B. Describe how students are using the library or other outside-the-classroom information resources.

Many of the assessment vehicles used in G/GS classes, e.g., poster presentations, PowerPoint presentations, guided research projects, and field trip reports require students to do extensive research outside of the classroom. Student presentations are required in courses taught by several G/GS instructors, including all three full timers, and many part-time instructors such as Marjan Rotting, Chris Bailey, and Claudia Seifert-Faulkner to name a few. Many of our books are accessible in PDF format, we have put textbooks and maps on reserve, and students utilize many on-line resources such as: Oregon Geology, SLIDO, DELESE- Digital Library for Earth System Education, Pacific Northwest Seismic Network, Cascade Volcano Observatory, and many journal articles, among many others. Much of this material can be accessed via the PCC library subject reference guide. There are two additional periodicals that would benefit students taking G/GS classes at PCC: 1) Earth, formerly known as Geotimes and published by AGI (information at http://www.earthmagazine.org/), not to be confused with an earlier magazine using the same name which was carried by PCC); 2) Geology, which is published by GSA (information at http://geology.gsapubs.org/).

Eriks Puris has discussed the possible future development of a centralized college-wide G/GS flipboard or some form of electronic site where faculty and potentially students could access these materials, or at least be aware of them. This centralized site could potentially contain information regarding job opportunities, transfer to four year colleges and universities, science clubs, local events, and a standardized method for students to request letters of recommendation.

Along with the outdoor field trips, our SAC utilizes other information resources in the area as well. Kyle Dittmer has GS 109 students visit the National Weather Service Office and KPTW studio and invites guest speakers Louise Lague (Weather and Psychological Impacts) and Steve Pierce (KOIN TV Meteorologist) to his classroom. Claudia Seifert-Faulkner also has a local meteorologist visit her classroom to talk about the weather. Andy Hilt and Marjan Rotting have students visit the Rice Museum of Rocks and Minerals to complete a lab exercise. Eriks Puris runs a weekend field trip course that utilizes the Mount St. Helens Learning and Science Center situated on the northern flanks of Mt. St. Helens National Monument.

C. Does the SAC have any insights on students' use of Advising, Counseling, Disability Services, Veterans Services, and other important supports for students? Please describe as appropriate.

The G/GS SAC has not had much interaction with PCC's Academic Advising Department. There is occasional interaction between the two when student scholarships or internships in the Earth Sciences become available to students at PCC. In the past, students have been offered the opportunity to apply for scholarships and internships with many agencies including: Oregon Space Grant Consortium (OSGC), Consortium for Ocean Science Exploration and Engagement (COSEE), Increasing Diversity in Earth Science (IDES), Undergraduate Catalytic Outreach and Research Experience (UCORE), National Science Foundation (NSF), etc. Eriks Puris and Andy Hilt serve as affiliates for OSGC, and therefore inform the advising departments and ASPCC group at their campuses so that students are aware of these opportunities. Students occasionally comment that an advisor recommended that they take one of our courses. On the other hand, G/GS faculty members are often asked to act as advisors regarding geology or environmental science programs at other universities or colleges, particularly Portland State University. Fortunately, we have been able to answer many of our students' questions, as a number of our part-time instructors have been students at local universities, and full-time instructor Melinda Hutson's husband is faculty in the Department of Geology at PSU. Eriks Puris set up a college-wide Geology Advising Session at the Southeast STEM center during November of 2015 (See Appendix 8). Students from all PCC campuses were invited to meet Michael Cummings and Martin Streck, who act as chairs and undergraduate advisors to students enrolling into the Geology program at Portland State University. Due to a family illness, Eriks could not attend this session, so Andy Hilt from Rock Creek stood in. The session was attended by nearly fifteen students, former students, and instructors from PCC and PSU. The students that attended were dominantly from Southeast, but also Rock Creek and Sylvania. This session proved to be highly beneficial for the students that attended. Many were able to lay out their entire undergraduate schedule by having experienced faculty from PSU on hand. The most important advice they received was to make sure to fit calculus and chemistry into their class schedule while at PCC. Having these courses completed prior to transferring to PSU would make it more likely for these students to graduate within four years rather than five.

The G/GS SAC has a good history of success working with Disability Services. Besides the fairly common requests for extended distraction-free testing sites, and classroom accommodations (furniture, note takers, signers), we have had some experience creating alternative field-based learning experiences for students with mobility difficulties. One of the issues currently being discussed in our SAC is the creation of virtual field trips and how they compare to actually "being there". We are also wrestling with how to create meaningful laboratory and field experiences for students who are visually impaired. Part time instructor Gretchen Gebhardt from Sylvania has been working on developing hands-on activities and acquiring materials to aide in the learning of visually impaired students in her hybrid Oceanography course. Eriks Puris and Amy Odman have been working with the maker space program at PCC to develop hands on models of Cascade volcanoes, layers of the Sun, and other relevant features. The SAC has discussed the benefit of such models for all learners, but anticipates a direct positive impact on specific disability groups as well.

Clerical, technical, administrative and tutoring support for G/GS classes is very uneven, depending on the departmental structure at each campus where the classes are offered.

At Sylvania, Geology and General Science are grouped together with Chemistry and Physics into the Physical Science Department. The current department Chair is chemist Patty Maazouz. The department has its own tutoring room with computers in AM 107. Tutors are hired for each discipline (Physics, Chemistry, and Geology/General Science) by the department.

At Rock Creek, Geology and General Science are included with Physics in the department of Physics and Geology, chaired by physicist Laura Fellman. As with Sylvania, there is no dedicated lab tech support of G/GS classes. Rock Creek has a tutoring center in Building 7, but there have not been a significant number of students requesting assistance in Geology or General Science courses over the last few years.

G/GS classes at Cascade are part of the Physics/Environmental and General Science department, chaired by physicist Tony Zable. Since there is no full time instructor at Cascade, students are not likely to have access to a tutor for G/GS classes. Cascade does not have a dedicated lab technician, and currently has no full time G/GS instructor to manage someone in this position. The SAC is struggling to fully understand the situation at Cascade because we have no permanent full time influence to assist us.

At Southeast, G/GS classes are grouped with biology, chemistry, and physics into the Math, Sciences, and Career Tech Education Division headed by Division Dean Alfred McQuarters. The G/GS discipline falls into a smaller department co-chaired by geologist Eriks Puris and biologist Alexi McNearthy. There is a tutoring center at Southeast, and Eriks Puris has assisted students as a volunteer instructor at the tutoring center.

With the G/GS program spread widely across PCC and with classes taught by so many part-time instructors, it has been difficult to maintain good communication between campuses. We have been fortunate in having about half of our part-time instructors attend most of our SAC meetings. We also utilize the MyGroups feature of MyPCC to provide links to useful sites for pedagogy (e.g., links to Starting Point-Teaching Entry Level Geoscience; National Association of Geoscience Teachers; Digital Library for Earth System Education) and for student research opportunities (e.g., links to UCORE; Oregon Space Grant). Copies of SAC files including agendas and minutes are posted in our MyGroups site as well. Some collaboration has occurred in the past, as instructors have utilized this space to download laboratory experiments, activities, and other teaching documents. Many of our current instructors have suggested that we develop this resource more fully in the future. According to our fall program review survey (See Appendix 9), there are a fair number of instructors that feel that an inventory of labs and activities would be a huge benefit, especially to recently hired instructors.

8. Recommendations

A. What is the SAC planning to do to improve teaching and learning, student success, and degree or certificate completion?

The three full-time instructors in the G/GS SAC have discussed a broad set of programmatic changes to improve student learning and faculty teaching. These changes focus on three areas: supporting student success, promoting pathways and broadening participation. The following section outlines proposed changes to instruction to support improvement in these areas and includes an aspirational goal for each area. Given current staffing and resources we view this as a decadal process.

i) Supporting Student Success

To promote student success our SAC is planning to shift the pedagogical approach of our courses towards a project based team problem solving approach focused on real world problems relevant to the student's communities. This approach will make our courses more engaging and relevant to our students while fostering the thinking, content knowledge and skills required by future geoscience graduates. The Summary Report for the Future of Geoscience Education (http://www.jsg.utexas.edu/events/files/Future_Undergrad_Geoscience_Summit_report.pdf) puts it this way:

> Independent research experience ("doing science") is one of the best tools for developing the skills described above. Ideally, that experience includes traditional research projects and/or internships, but shorter non-traditional research opportunities are also an excellent vehicle for obtaining experience: e.g. real-time data collection/analysis related to local geoscience issues. . . . Experience working in teams is a critical component of a next-generation geoscience education. Coaching/advising, including discussion of the intended teamwork outcomes, helps students to integrate knowledge and build confidence. Teamwork is also a vehicle to build "student hubs" that can energize the broader student population.

For each course we aim to:

- Go through a backwards design process to identify local geoscience problems (geoproblems) and case studies which are relevant to the students and their communities and that can be used to meet course level outcomes. Possible examples of geoproblems include: the assessment of local geological hazards including landslides, the Boring Volcanic Field in the Portland Basin, radon in student residences, the impact of climate change on the Pacific Northwest and the magnitude 9 Cascadia subduction zone earthquake (aka The Big One). Possible case studies include: the Vanport floods, the link between seasonal upwelling and dead zones off the Oregon coast, the impact of past El Niño events on the Pacific Northwest and the analysis of past weather related closures of PCC using data from campus weather stations.
- Developing local long term monitoring and research projects that multiple courses can contribute to over multiple years. Possible examples include water quality monitoring in local streams, identification and monitoring of potentially unstable slopes, weather data collection at PCC campuses, monitoring of light pollution.
- Include opportunities for community based learning including educational outreach about geoscience issues relevant to our local communities to student peers on PCC campuses and to local high schools and middle schools.
- Develop focused and assessable course objectives much like the chemistry SAC has begun to develop. These course level objectives would specify the geoscience problems and case studies to be addressed in each course. Each instructor would then meet these course objectives in their own manner. These course objectives would then be connected to course level outcomes that connect to college level outcomes.
- Create college-wide common course materials to support these geoproblems, case studies, monitoring and research projects. This would include purchasing and using common equipment on the campuses as well as lab handouts, test questions and assessments.
- Develop more robust methods and expectations for faculty from different campuses to share content knowledge regarding the geoproblems investigated in our courses, the results of long term monitoring and research projects in our courses, as well as student learning successes and failure in our courses.

The G/GS course offerings would evolve to support this type of learning and this evolution is already underway. The SAC has added independent study courses (G298s) and field trip based courses (G200s) to the existing G 161 and G162 field based courses. These one to two credit specialty courses allow the piloting and development of project based learning before incorporating project based learning into general education courses. The G201, G202, G203 course cluster which is a requirement for geology majors at Oregon universities, is well suited for the project based approach as these courses balance breadth with depth. The existing GS courses however are much more of a challenge as these one quarter overview courses stress breadth over depth. These courses are extremely challenging to beginning students who are overwhelmed by the volume of vocabulary and the amount of detail in these courses and who frequently find themselves lost in the encyclopedic nature of these courses. We propose to replace some of the GS courses with on-ramp courses that engage students by focusing on issues relevant to their communities and are accessible to a broad array of students due to their low level math barriers to entry. We have already created two such courses G148 Volcanoes and Earthquakes and G184 Global Climate Change (which have a MTH 20 prerequisite). Future additions could include G147 Geology of National Parks (which already exists at some Oregon Community Colleges) or new courses such as Water Resources or Habitability of Terrestrial Planets. Overtime the existing GS courses may be retired with the exception of GS 109 Physical Science (Meteorology), which is required by the Aviation Science program. Further changes to the curriculum would include changing G 207 (Geology of the Pacific Northwest) to a course that can be taught with or without a lab—the non-lab version would be DL only. When taught over the summer, the lab version could be taught as a field based course and function as a capstone experience for students that complete the G 201, 202, 203 cluster. Several courses could be eliminated including G 291 which has not been taught for years, and G 208 Volcanoes and G 209 Earthquakes which are 3 credit lecture only courses that cover much the same content as the new G 148 Volcanoes and Earthquakes course which is 4 credits and includes a lab.

Our aspirational goal is to develop a set of G/GS courses that have all the attributes of excellent STEM teaching and learning as outlined by the South Metro-Salem STEM HUB (see: http://www.oit.edu/strategic-partnerships/stem-partnership/educators/smsp-stem-attributes-framework). Each course would:

- Integrate science, technology, engineering and math
- Develop communication and literacy skills
- Provide authentic real-world experiences through contextual learning (may include active citizenship)
- Form partnerships with business, industry, agencies and non-profits (may occur outside the school)
- Provide career awareness through four year and career relevant connections
- Foster problem-solving, critical thinking and argumentation skills through inquiry and design
- Include effective instructional strategies that develop collaboration and teamwork
- Use equitable instructional practices that are inclusive to all students regardless of gender, disability, ethnicity, race, language, socioeconomic status, gender identify, and sexual orientation
- Use standards-based performance/proficiency assessments

ii. Promoting Pathways

To promote pathways our SAC will conceptually reorganize our discipline's curriculum from a set of unconnected courses to a coordinated collection of courses in which different types of courses play different roles in the student's education. A further challenge will be to change the SAC culture to include wrap around services such as career, scholarship, internship and transfer information and advising as part of our in class instruction.

Our curriculum can be viewed as consisting of three types of courses:

1) **On Ramp Courses**: these are either low stakes experiential courses such as one credit field trips (the G 200s) or topic driven low math barrier general education courses such as the new G 148 Volcanoes and Earthquakes and the G 184 Global Climate Change. These courses are designed for students who have never had a geoscience course (fewer than 25% of high school students take a geoscience course in high school). As a side note G 200 transfers to PSU as a required course for the PSU Earth Science major.

2) **Skill Courses**: these are the standard G 201, G 202, G 203 course cluster that transfer to Oregon University as required courses Geology majors. These courses are designed to build the skills and knowledge required to succeed as a geoscience major in a 4YC.

3) **Capstone Courses:** these courses give students a chance to apply the knowledge and skills developed in on-ramp courses and skill courses. Examples include G 161 and G 162 which are 2 credit field trip courses taught in spring, the G298 independent study courses and the proposed lab version of G 207 Pacific Northwest Geology which could be taught as a field based course during summer quarter.

While the courses would be designed to fill specific rolls in our curriculum students could use them in various ways:

> **-an underprepared student entering PCC clueless as to their career goals** might take a four credit on-ramp course about a 'cool topic' to meet their general education requirement and then discover they are interested in geology. They would then have to work to meet the MTH 95 prerequisite for the G 201, G 202, and G 203 cluster. While they are working to develop their math skills they might take additional one credit on-ramp courses to maintain their connection to the geosciences and meet students with similar interests.
>
> -**a well prepared student continuing student who enters PCC knowing they are going to study geology** might start with the G 201, G 202, and G 203 cluster and then use the on-ramp courses to deepen their knowledge about specific topics.
>
> -**a returning student who discovers they want to pursue geology** while taking G 201 to meet their general education requirements during their second year at PCC, might finish the G 201, G 202, G 203 cluster and then have to spend more time at PCC building up their chemistry and

math prerequisites prior to transferring to a 4YC. While they are concentrating on basic math and science courses the one credit one ramp courses can serve to keep their interest in geology stoked and keep them connected with students that have similar interests.

a life-long learner may concentrate on capstone field trip courses to deepen their sense of place in the Pacific Northwest

To promote geoscience pathways and support students along these pathways the SAC would begin to integrate wrap around student support services into our courses. Some of this is already starting to occur, these early efforts need to be supported an institutionalized. Some of the ways we could begin to develop these wrap around services include:

- Creating a student friendly SAC web page (possibly in spaces) with photos of all of our instructors, information about the G/GS program and courses, and geoscience web links used in our courses that our students could return to after they finish their courses (unlike web links in D2L).
- Participate in outreach to local K-12 schools ideally by having PCC student make presentations. The SAC already participates in Preview Day at SE and Hermana at RC, in addition Bridger Middle School and Alder Elementary School have visited the geology labs at SE.
- Creating a trifold pamphlet advertising the G/GS program at PCC to hand out at outreach events.
- Alert students in class to geoscience events and opportunities in the Portland metro area.
- Supporting the development of student clubs.
- Create in house web pages and PowerPoints highlighting geoscience careers and current wage and hiring trends in the geosciences nationally and in the Portland region. These would be distributed to our instructors to use in their courses.
- Develop stronger links to neighboring 4YCs (especially PSU), employers, government agencies and professional groups. This would be done by advertising events at these institutions, attending events at these institutions with students, leading field trips to these institutions and having guest lecturers from these institutions visit our classes.
- Partner with local area institutions to develop societally relevant community focused research projects which can be included into G/GS courses.
- Inform students of internship and research experiences, educate students about the calendar for applying to internships and scholarships, and spend class time going over the application process and letters of reference. Include a section on the SAC web page about how to how to write applications and ask for recommendation letters.
- Develop some sort of longitudinal tracking of our students that allows us to invite former students active in the geosciences to return to PCC to share their experiences with current students and the SAC, which can apply their experiences to improving our geoscience pathway.

While this level of pathway advocacy may seem excessive for a program that is dominated by general education students it has the instructional benefit of making what we teach more current, topical and real world which makes our courses more engaging which benefits all students.

Our aspirational goal is to get more students into undergraduate research experiences (REUs) and internships. The SACs experience with the University of Oregon UCORE (Undergraduate Catalytic and Outreach Experience) program and the OSU IDES (Increasing Diversity in the Earth Sciences) program has demonstrated the immense benefit of undergraduate research experiences to our students. One of the shortcomings of these programs, other than their short funding cycles, was that they required our students to spend a significant part of their summer in Eugene or Corvallis. Many of our students are place bound and this requirement proved an insurmountable obstacle for many students. A further aspirational goal for our SAC is to develop an externally funded summer research/internship experience suited to the place bound nature of our students.

iii. Broadening Participation

To broaden participation our SAC will incorporate positive factors that enable diverse students to enter and persist in STEM programs into our curriculum. The SAC wants to create an inclusive, culturally relevant learning climate that reduces the barriers faced by underrepresented minorities as they try to gain access to the STEM pathway. Increased diversity in our classrooms will bring multiple viewpoints to the classroom leading to better problem solving improving the learning experience in our classrooms. A recent overview of positive factors can be found in “Designing for Success” (http://www.ibparticipation.org/pdf/Designing_for_Success.pdf). Many of these positive factors dovetail with the previously discussed proposed changes in the sections on supporting student success and promoting pathways illustrating the concept of universal design, that by making courses accessible to all students course are improved for all students. Some positive factors the SAC will work on incorporating into its curriculum include:

- Early exposure to STEM Fields: outreach by G/GS students to adjacent K-12 schools highlighting geoscience problems relevant to the local community.
- Outreach to student families: so that families become familiar with the geosciences and better understand the student’s interest in the geosciences. Field trips that include family members are a potential approach.
- Authentic science engagement: developing problem driven project based courses that address community issues will engage underrepresented students who often value having a career that

makes a social contribution to their community

- Role Models: the SAC will search for geoscientist from underrepresented groups that can be used as role models and will consciously try to seek out slides with members of underrepresented groups engaged in geology as these are very sparse in most geoscience texts.
- Professional Development: connect students with programs, internships and REUs that seek to broaden participation in the geosciences such as LSAMP and IDES.

Our aspirational goal is to weave practices that broaden participation into our SACs way of doing things to the point that the next time a full time instructor position opens in our SAC potential candidates from underrepresented groups are not put off by the lack of diversity at PCC and do not feel that they will need to spend a considerable amount of their time at PCC developing programs to increase diversity, but rather can concentrate on teaching. This will hopefully lead to the eventual hiring of a full time instructor from an underrepresented group.

The proposed changes in the three broad area of supporting student success, promoting pathways and broadening participation outlined above are, to a large extent, overlapping and interlocking as they all hinge on engaging students with meaningful material, developing skills using real world problems, highlighting career opportunities within the geosciences, and relating geoscience to the our student's community's needs. Furthermore the proposed changes in the three broad areas intertwine with PCCs strategic intentions.

- The proposed changes in the area of supporting student success further strategic intentions 1-2, 1-4, 1-6, 1-7, 2-2, 2-4, 3-1, 3-2, 4-1, 6-1, 6-2.

- The proposed changes in the area of promoting pathways further strategic intentions 1-3, 1-4, 1-5, 1-7, 2-1, 2-2, 2-3, 2-5, 2-6, 3-1, 3-2, 3-5, 4-1, 4-2, 4-4, 4-5, 5-4, 6-1, 6-6.

- The proposed changes in the area of broadening participation further strategic intentions 1-7, 2-2, 2-5, 3-2, 5-1, 5-2, 5-4, 6-1, 6-6.

B. What support do you need from the administration in order to carry out your planned improvements? For recommendations asking for financial resources, please present them in priority order. Understand that resources are limited and asking is not an assurance of immediate forthcoming support, but making the administration aware of your needs may help them look for outside resources or alternative strategies for support.

i) ***We need three additional full-time faculty. Our most pressing need is at the Cascade campus, where there is currently no full-time presence. Given the number of classes taught by part-time instructors, out next most pressing needs would be at the Sylvania campus, and then at the Rock Creek campus. We need expertise in distance-learning (DL), meteorology, and oceanography. Ideally, we would be able to attract excellent candidates who would add greater diversity to our SAC.***

Our top priority is additional full-time faculty. Truly innovative change ***driving student success*** *and* ***igniting a culture of innovation*** requires collaboration among G/GS faculty over a long (decadal) period of time. Our SAC has been fortunate in the last decade to have dedicated part-time faculty who have contributed greatly to student success at PCC. These include Karen Carroll who almost single-handedly set up G/GS at Cascade (no longer at PCC), Frank Granshaw who created the materials for many of the GS classes that are still being used today (no longer at PCC), and Jill Betts and Gretchen Gebhardt who created the DL versions of G 201/202 still being taught today (Jill Betts is no longer at PCC). The problem with hard-working dedicated part-time faculty is that they tend to become full-time employees of other institutions. Almost all of the concepts outlined in section 8A resulted from discussions among only the three full-time G/GS faculty that were scheduled during ad-hoc meetings throughout the last few academic years. It is crucial to have full-time representation on each PCC campus where G/GS courses are taught, particularly when there is no lab tech support.

There are no specific guidelines for full-time/part-time ratios of faculty in geosciences, but the American Chemical Society guideline for faculty state "Full-time permanent faculty should be sufficient in number to teach the full range of courses on a regular basis, with the number of credit hours taught by permanent faculty exceeding 75% of the total chemistry offerings." As stated in section 1A, over 75% of our courses are taught by part-time instructors, and our full-time instructors do not teach all of our courses during an academic year.

There is an ever-increasing desire by students for distance-learning (DL) classes. As noted in a 2007 survey of students taking DL classes (Journal of Education and Human Development - http://www.scientificjournals.org/journals2007/articles/1041.htm): "The majority of the participants (66%) identified timeliness, dependability, and flexibility as the major factors that motivate them to participate in distance learning, while 25% identified efficiency as the major factor, and only 9% indicated that they attend because of its self-directed learning approach. The issues of transportation, childcare, and uninterrupted career path were widely mentioned by a majority of participants (98%). Again, flexibility was mentioned (89%) as the major motivating factors in participating in distance learning." DL courses ***ignite a culture of innovation*** by being responsive to shifting student and societal demands and ***lead in diversity, equity and inclusion*** by giving all people equal access to opportunities. We need a full-time instructor with expertise in DL.

ii) ***We need support for Field-Based learning. The two main things we need are: transportation for students (vans), and an easy mechanism for making student fees available to support field trip costs.***

As discussed in section 3B, it is widely accepted that Field-Based learning ***drives student success*** in the geosciences. Yet, many of the faculty in the G/GS SAC have heard from students who were unable to participate in a class field trip due to lack of transportation (didn't have a car or lacked gas money). Many colleges (e.g., Mt. Hood Community College, Portland State University) that have geoscience courses provide vans for transportation to field locations. Having vans would allow PCC to ***lead in diversity, equity, and inclusion***, while ***providing outstanding affordable education***.

The first sections of G 160 and G 161 (both field trip courses) were taught many years ago at the Sylvania campus. Fees to cover the cost of these trips were collected from students and went into a general fund. When the bills arrived, the Physical Science Department did not have the funds to cover them and discovered there was no easy way to transfer funds immediately before, during or immediately after a term when a trip is offered. This has been an impediment to scheduling field-trip classes, and we ask that some mechanism be found for making student fees easily available to support field trips.

iii) ***We need equipment and lab tech support to allow for a more common hands-on curriculum across campuses. The most important pieces of equipment are lap-top computers (need 7 each at Sylvania and Rock Creek), and on-campus weather stations. Additional equipment would include stream tables (at Rock Creek and Cascade) and ground water models (Cascade). Equipment is not as valuable without lab support to set up, tear down, and maintain the equipment. We ask for lab tech support at each campus. Such support could be half-time positions or a combination tech support/instructional position***.

Most of the G/GS classes include a laboratory component. While all four campuses have rock and mineral samples, rocks and minerals are only part of the topics covered by our courses. In the absence of equipment to help with hands-on interactive laboratory exercises (such as a stream table), students have to fall back on old-fashioned lab manuals composed of work sheets based on photos and maps. ***Outstanding, innovative*** geoscience education that ***drives student success*** involves active-learning with either experiments using equipment or observations in the field.

iv) ***We need time for SAC members to interact. This involves instructor scheduling, the purchase of web cams, and the addition of a Winter term SAC inservice day***.

The amount of time spent on-instructional SAC duties (assessment of PCC outcomes, dual credit meetings and evaluations, etc.) has increased greatly since our last program review. Much of these duties are carried out almost entirely by the three full-time G/GS faculty outside of the two scheduled SAC meetings per year. For example, this program review has involved a steady stream of e-mails and roughly a dozen meetings by the three full-time faculty. Yet, scheduling those meetings has been difficult, as we are at three different campuses with two of us having almost diametrically opposite teaching schedules. To implement the plans discussed in section 8A, the full-time faculty will need to be able to schedule regular meetings. The administration could help by having our teaching schedules arranged so that there is a common non-instructional time available. Additionally, having web cams and software such that we could have virtual meetings rather than have to drive to one location would also facilitate program changes. Finally, many of the part-time instructors teach at times outside of the work day of the full-time instructors. These part-time instructors often only interact with the rest of the SAC during inservice days. Ideally, there would be one SAC inservice day each term (fall, winter, spring) to enable face-to-face communication between all SAC faculty. This will enable our SAC to ***ignite a culture of innovation*** that will help ***drive student success***.

v) ***We ask PCC to continue to provide and to expand support for professional development, including funding for conferences, workshops, and technical training for lab and field equipment. This includes travel funds as well as funds for substitute teachers for faculty attending a conference or workshop***.

The opinions of 11 members of the G/GS SAC regarding professional development are given in questions 36-39 in Appendix 9. Roughly one-third of the respondents rated PCC's support for professional development activities as "measly", while two-thirds chose "adequate". None of the respondents thought that PCC's support was "plentiful". As one part-time instructor commented "I feel that the support in terms of money and substitute instructors is inadequate to regularly attend national meetings. I am having problems staying current in my field."

The background knowledge needed by our instructors is not set in stone. Plate tectonics is the youngest of the overarching scientific theories and is still evolving. In the past decade, there have been new discoveries about the Earth, with a great deal of new scientific information, such as the likelihood of slightly less large, but more frequent earthquakes along the southern half of the Cascadia subduction zone. Topics that are covered in textbooks, such as the interior of the Earth, are lagging behind current knowledge. The main conferences that help keep faculty current in their field are GSA's meetings (Cordilleran section and annual meetings), and AGU's fall meeting in San Francisco. All of these meetings are held at times when PCC instructors are teaching classes.

As discussed in section 5C, full-time instructor Andy Hilt attended the 2nd Summit on the Future of Undergraduate Geoscience Education department Heads, and many of the G/GS faculty have been involved in several programs (Sage 2YC, NAGT, SERC) that offer workshops on a variety of aspects dealing with geoscience education. It is important to keep abreast of new innovations in geoscience education as well as in knowledge of content. Again, many of these workshops and summits take place during the school year, requiring that faculty miss classes to attend them.

Support for professional development requires several things, including:

- Funds for registration and travel. While some opportunities present themselves with a lot of advance warning, others appear (e.g., via a passed-on e-mail) with short notice. As one of our part-time instructors commented in Appendix 9, "I attempted to get funding for my trip, but missed the deadline due to my late decision to attend." Lack of funding is a serious barrier for professional development, particularly for part-time instructors.

- Not losing salary. Faculty are granted 3 personal leave days during a year. This means that attending a slightly longer conference or attending two or three short workshops in a year requires taking a leave without pay, which is a sufficient barrier to preclude faculty from participating in all but one small professional development activity during the academic year.

- Substitute teachers. Caring, responsible faculty are less likely to take advantage of an opportunity to attend a workshop or conference if they know that their students will be missing class while they are gone. At Sylvania, Melinda Hutson was informed that in the event of missing class due to illness, substitutes would only be available for her 3 hour long classes, but not the 1 ½ hour classes taught twice per week (Patty Maazouz, personal communication). This is an incentive for coming to work ill, and a disincentive to attend a workshop or conference during class time.

Almost none of the G/GS faculty are recent college graduates, and some of us received our degrees decades ago. Most of us received little or no training in education during our college training and simply taught the way we were taught. Workshops, conferences, and interactions with fellow SAC members are the methods by which we will learn the content and techniques to improve the ways in which we facilitate student success at PCC and ***ignite a culture of innovation***.

APPENDIX 1
G/GS Course Content Outcome Guidelines
(CCOG's)

Course Number: G 148
Course Title: Volcanoes and Earthquakes
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 30
Special Fee:

Course Description
Explores the Earth's volcanism and seismicity examining its nature, geographic distribution, frequency, magnitude, and relation to plate tectonics. Covers the assessment of hazards and risks associated with volcanoes and earthquakes and how communities can manage these hazards and risks. Includes a weekly lab. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores. Audit available.

Addendum to Course Description
Volcanoes and Earthquakes (G 148) is a one-term introductory course in volcanology and seismology, which are branches of the science of geology. The student will develop an understanding of the types, origin, activity, products, and hazards of volcanoes and earthquakes. This course can be used to partly fulfill graduation requirements for the Associate Degree, and has been approved for block transfer. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the geologic time scale and the evolution of the Earth.
Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation. Creation science, also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that creation science is anything other than pseudoscience.
Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.
Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the Course
Students who successfully compete this course should be able to:
1. Use their understanding of basic physical and chemical processes to describe the mechanics of volcanic eruptions and earthquakes.
2. Use their understanding of plate tectonics to explain the variety and geographical distribution of volcanoes and earthquakes.
3. Identify landscape features of the Pacific Northwest associated with volcanic and earthquake activity

and describe the events that formed them.

4. Use the geologic history of earthquake and volcanic activity in the Pacific Northwest to assess the likely magnitude and frequency of future earthquake and volcanic activity in the Pacific Northwest.
5. Make field, laboratory and web based observations and measurements of volcanic and seismic activity and landforms, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of volcanic and seismic processes identifying areas of congruence and discrepancy.
6. Access volcano and earthquake science information from a variety of sources, evaluate the quality of this information, use this information to evaluate the hazards and risks posed by earthquakes and volcanoes to a specific geographic area, examine how these risks can be managed, and effectively communicate the results of this analysis to others.

Course Activities and Design

The material in this course will be presented in a lecture/discussion format and laboratory exercises. Other educationally sound methods may be employed such as guest lectures, field trips, research papers, and small group work.

Outcome Assessment Strategies

At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, laboratory write-ups, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a personal work journal.

Course Content (Themes, Concepts, Issues and Skills)

- Describe the relationship of volcanoes to plate boundaries
- Classify the types of rocks created by volcanic processes
- Contrast pyroclastic and effusive eruption styles
- Examine the effect of silica content on eruption style
- Discuss a number of historical volcanic eruptions and determine the major cause of human destruction for each case
- Explore the methods used to forecast volcanic eruptions
- Classify the features that occur in volcanic landscapes
- Define the different kinds of plutons
- Discuss the hazards associated with the Cascade volcanoes
- Define the following terms: shield volcano, composite volcano, cinder cone, lahar, pyroclastic flow, pahoehoe, aa
- Discuss the effects of volcanic eruptions on climate
- Describe what is meant by "earthquake".
- Define the following terms: focus, epicenter, refraction, reflection.
- Describe the different types of seismic waves.
- Describe the relationship of earthquakes to plate tectonics.
- Define the following terms: strain accumulation, creep, foreshock, main shock, aftershock, interplate earthquake, intraplate earthquake.
- Describe how a seismograph works.
- Locate an earthquake epicenter using travel-time curves and three seismic records.
- Describe how earthquakes can be used to study the interior of the earth.
- Locate underground faults and describe crustal structure using a seismic profile.
- Classify the different types of faults that result from earthquakes.

- Define the following terms: strike-slip, dip-slip, oblique-slip, hanging wall, foot wall.
- Describe the landforms produced along faults.
- Describe the causes of earthquakes.
- Define the following terms: compression, dilation, elastic rebound, compressive stress, tensile stress, fault-plane diagram
- Identify the different types of seismic waves on a seismogram and determine the motion along the fault from the first motion of the p-wave.
- Describe the relationship between earthquakes, volcanoes and tsunamis.
- Define the following terms: soil liquefaction, slickensides, sand boils, clastic sills.
- Discuss a number of historical earthquakes and determine the major cause of destruction for each case.
- Describe the events that precede earthquakes.
- Describe the evidence for past earthquakes along the Cascadia subduction zone.
- Describe steps that an individual can take to protect against earthquake damage
- Describe methods for making buildings and other structures more earthquake resistant.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=148 Accessed 3/27/2016

Course Number: G 160
Course Title: Geology: Oregon Coast
Credit Hours: 2
Lecture Hours: 10
Lecture/Lab Hours: 20
Lab Hours: 0
Special Fee: $6.00

Course Description
Designed to introduce the relationships between the biology and geology of the Oregon Coast.

Addendum to Course Description
Geology: Oregon Coast (G 160) is a one-term course that explores the geologic history of the Oregon Coast and the relationships between geology and the plants and animals of the Oregon Coast. Students will go on a three-day field trip to the Oregon Coast to get hands-on experience of concepts covered in the lecture portion of the class..

Intended Outcomes for the course
After completion of this course, students will:

A. Apply an understanding of basic ecological principles to the plant and animal species living on the Oregon Coast to appreciate the complexity of factors that influence the "web of life" and our place within it.
B. Apply a basic knowledge of geological processes that formed this region to the impact this geology has on the biological organisms found here
C. Use scientific field research equipment
D. Communicate effectively orally and in writing
E. Successfully apply basic geological concepts in future coursework.

Course Activities and Design
The material in this course will be presented in a classroom lecture/discussion format with an accompanying field trip. Other educationally sound methods may be employed such as research papers and small group work.

Outcome Assessment Strategies
At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, research papers, group projects, oral presentations, or maintenance of a personal field journal.

Course Content (Themes, Concepts, Issues and Skills)

1. Collaborate with peer - work effectively in groups.
2. Analyze soil or water samples using field laboratory kits
3. Describe the geologic history of the Oregon Coast
4. Describe the rock units that form the bedrock of the Oregon Coast
5. Define the following terms: graywacke, blueschist, turbidite, pillow lava, estuary
6. Describe the relationship between different dune environments and the plants found in those environments
7. Discuss human impact on the Oregon Coast
8. Measure strikes and dips of folded rock layers
9. Discuss the formation of marine terraces and sea stacks
10. Define the following terms: anticline, syncline, symmetric and asymmetric folds

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=160 Accessed 3/29/2016

Course Number: G 161
Course Title: Geology: Great Basin/Cascades
Credit Hours: 2
Lecture Hours: 20
Lecture/Lab Hours: 0
Lab Hours: 0
Special Fee:

Course Description
Introduces the relationships between the biology and geology of the Great Basin and/or Cascades geographical area. Explores the geologic history of the Great Basin and/or Cascades geographical areas and the relationships between geology and the plants and animals of these areas. Includes a four-day field trip to the Great Basin and/or Cascades geographical area for field experience of concepts covered in the lecture portion of the class.

Intended Outcomes for the course
After completion of this course, students will:

A. Understand the basic geological processes that formed this region and the impact this geology has on the biological organisms found here
B. Be able to use select scientific field research equipment
C. Have the ability to communicate scientific concepts effectively through written and oral reports
D. Be prepared for future study in geology or related fields

Course Activities and Design
The material in this course will be presented in a classroom lecture/discussion format with an accompanying field trip. Other educationally sound methods may be employed such as research papers and small group work.

Outcome Assessment Strategies
At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, research papers, group projects, oral presentations, or maintenance of a personal field journal.

Course Content (Themes, Concepts, Issues and Skills)

1. Collaborate with peers - work effectively in groups.
2. Analyze soil or water samples using field laboratory kits
3. Describe the geologic history of the Malheur and Great Basin geographical areas
4. Describe the volcanic processes that formed Diamond Craters
5. Discuss the geologic formations associated with hydrothermal activity
6. Describe the relationship between the geology and the biological organisms in desert environments
7. Discuss human impact on the Malheur region

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=161
Accessed 3/29/2016

Course Number: G 184
Course Title: Global Climate Change
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 30
Special Fee:

Course Description
Covers characteristics of Earth's climate system. Includes the atmosphere, ocean, biosphere, and solid Earth as well as past, present, and future climate change and future mitigation and adaptation efforts. Includes a weekly lab. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores. Audit available.

Addendum to Course Description
The purpose of this course is to develop an understanding of Earth's climate system and climate change, including historical perspectives. It is a one-term survey course that may be included as part of the year's sequence in physical science for college transfer credit.

The course will have as many of the following components as feasible: lectures, discussions, lab activities, videos, CDs, slides, live television and computer reports, and computer-aided instruction. It is necessary to successfully complete the lab part of the course in order to pass the course.

The text and materials for this course have been chosen by the faculty and viewpoints shall be that of the author(s). This includes the topics of relativity, the geologic time scale, evolution of the Earth and its atmosphere, the solar system, the galaxy and the universe.

Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. Creation science, also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that □creation science□☐ is anything other than pseudoscience.
4. Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations to successfully complete this course

Intended Outcomes for the course

After taking this course, students should be able to:

1. Use an Earth system perspective that includes the atmosphere, hydrosphere, solid earth, and biosphere to explain past, present, and future global climate patterns.
2. Identify both human and non-human forcings on the climate system and the system response to these forcings including possible feedback mechanisms.
3. Use real data to document climate change impacts both globally and in the Pacific Northwest and link these changes to the current scientific understanding of climate change.
4. Make field, laboratory and web based observations and measurements of climate, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of the climate system identifying areas of congruence and discrepancy.
5. Access climate science information from a variety of sources, evaluate the quality of this information, and critically compare this information with current models of the climate system.
6. Use scientifically valid modes of inquiry, individually and collaboratively, to critically assess the hazards and risks posed by climate change, to themselves and society, and evaluate the efficacy of ethically robust responses to these risks.
7. Communicate effectively about Earth's changing climate, its impacts, and possible responses from an Earth System perspective.

Course Activities and Design

The laboratory is not separate from the lecture, but will usually be correlated in such a way as to reinforce the materials being discussed in the lecture section. It is necessary for the student to successfully complete the laboratory section of the course in order to earn a grade in the course. Math will be used to solve ratio, percentage, and simple algebraic problems. Also included are the design, reading, and interpreting of graphs.

Outcome Assessment Strategies

The instructor will choose from the following methods of assessment: exams, quizzes, lab exercises, written reports, oral presentations, group projects, class participation, homework assignments, and field trips. The instructor shall detail the methods to be used to the students at the beginning of the course.

Course Content (Themes, Concepts, Issues and Skills)

- Explain the nature and history of climate science
- Outline basic concepts of systems such as couplings and feedback loops
- Discuss the basic physical principles of energy in the Earth system
- Discuss the basic structure and dynamics of the solid Earth
- Discuss the basic structure and dynamics of Earth's atmosphere
- Discuss the basic structure and dynamics of Earth's oceans
- Discuss the basic structure and dynamics of Earth's biosphere
- Outline the details of nutrient cycles that link the elements of the Earth system
- Discuss climate zones on Earth and the factors that shape them
- Explain how and why the climate changes on a variety of time scales including long-term climate history and future climate change
- Discuss how humans impact climate
- Outline the structure of a global climate model and how climate models can be used
- Outline Pacific Northwest and global impacts of climate change

- Identify how decisions are made globally with respect to climate
- Compare and contrast adaptation, mitigation, and geoengineering techniques used to lessen the effects of climate change
- Other topics as desired by the instructor

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=184 Accessed 3/29/2016

Course Number: G 200A
Course Title: Geology Field Studies
Credit Hours: 2
Lecture Hours: 0
Lecture/Lab Hours: 40
Lab Hours: 0
Special Fee: $12.00

Course Description
Introduces basic concepts of geology through field experience. Includes both lecture and field components. Content varies based on site location. Prior geology experience recommended. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores. Audit available.

Addendum to Course Description
It is recognized by the geology/general science SAC that different field trip sites differ in complexity. Additionally, an instructor may choose to concentrate on a few of the major processes that have shaped a particular location, rather than all of the processes (major and minor). Thus the breadth and depth of geological knowledge attained by a student will vary depending on the chosen site and the goals of the instructor. A student will spend 20 hours per credit in a combination of lecture/study and field observation/exercises to adequately master the outcomes and content offered by a particular site.

Intended Outcomes for the course
Upon completing this course, students should be able to:

A. appreciate the geologic history of a field area by combining site specific content knowledge with basic firsthand exposure to the site itself
B. use field research equipment to collect scientifically valid observations and data
C. connect current environmental and/or land use concerns affecting the study area to the geologic history of the study area
D. communicate geologic concepts effectively using maps and diagrams in written and/or oral formats.

Course Activities and Design
The material in this course will be presented in a classroom lecture/discussion format with an accompanying field trip. Other educationally sound methods may be employed such as research papers and small group work. Curriculum materials for a specified site will be approved by the geology/general sciences SAC before the site-specific course is offered.

Outcome Assessment Strategies
At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, research papers, group projects, oral presentations, or maintenance of a personal field journal.

Course Content (Themes, Concepts, Issues and Skills)
Course content varies based on location
Content common to any location includes:

A. Collaborate with peers - work effectively in groups
B. Describe the geologic history of the study area
C. Identify the rocks found in the study area
D. Discuss human impact on the study area

E. Describe the relationship between the geology and the biological organisms in the study area
F. Describe the geologic processes that are typified by the study area

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=200A
Accessed 3/29/2016

Course Number: G 200B
Course Title: Geology Field Studies
Credit Hours: 4
Lecture Hours: 0
Lecture/Lab Hours: 80
Lab Hours: 0
Special Fee: $24.00

Course Description
Introduces basic concepts in geology through field experience. Includes both lecture and field components. Content varies based on site location. Prior geology experience recommended. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores. Audit available.

Intended Outcomes for the course
Upon completing this course, students should be able to:

A. appreciate the geologic history of a field area by combining site specific content knowledge with moderate first?hand exposure to the site itself
B. use field research equipment to collect scientifically valid observations and data
C. connect current environmental and/or land use concerns affecting the study area to the geologic history of the study area
D. communicate geologic concepts effectively using maps and diagrams in written and/or oral formats.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=200B
Accessed 3/29/2016
Course Number: G 200C
Course Title: Geology Field Studies
Credit Hours: 6
Lecture Hours: 0
Lecture/Lab Hours: 120
Lab Hours: 0
Special Fee: $45.00

Course Description
Introduces basic concepts in geology through field experience. Includes both lecture and field components. Content varies based on site location. Prior geology experience recommended. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores. Audit available.

Intended Outcomes for the course
Upon completing this course, students should be able to:

A. appreciate the geologic history of a field area by combining site specific content knowledgewith extensive first?hand exposure to the site itself
B. use field research equipment to collect scientifically valid observations and data
C. connect current environmental and/or land use concerns affecting the study area to thegeologic history of the study area
D. communicate geologic concepts effectively using maps and diagrams in written and/or oralformats.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=200C

Accessed 3/29/2016
Course Number: G 200D
Course Title: Geology Field Studies
Credit Hours: 1
Lecture Hours: 10
Lecture/Lab Hours: 0
Lab Hours: 0
Special Fee:

Course Description
Introduces basic concepts in geology through lecture and field trip. Content varies based on site location. Prior geology experience recommended. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores. Audit available.

Addendum to Course Description
Geology Field Studies (G 200 D) is a one credit course designed to engage students with the earth sciences by examining the geology of a particular field area. The course consists of a one day field trip buttressed by supporting lectures that introduce aspects of geology as needed to explain the geology of the particular field area. This course can be run to different field areas and the specific course content will vary with each area visited. This course can be used to partly fulfill graduation requirements for the Associate Degree. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the geologic time scale and the evolution of the Earth. Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. "Creation science", also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that creation science" ☐ is anything other than pseudoscience.
4. Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the course
Upon completing this course, students should be able to:

A. narrate the geologic history of a region by combining site specific content knowledge with limited

personal field observations and experiences of the site.
B. connect current environmental and/or land use concerns affecting the study area to the geologic history of the study area.
C. communicate geologic concepts effectively using maps and diagrams in written and/or oral formats.

Course Activities and Design
The material in this course will be presented in a combination of field trip and lecture/discussion. Other educationally sound methods may be employed such as collection of field data, small group work, research papers and guest lecturers.

Outcome Assessment Strategies
At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, field trip write-ups, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a field note book.

Course Content (Themes, Concepts, Issues and Skills)
- Geologic materials and structures underlying the field area.
- Internal and external processes which produced the geologic materials and structures underlying the field area.
- The geologic history recorded by the geologic materials and structures underlying the field area.
- Geologic hazards associated with the field area.
- Geologic resources associated with the field area.
- The impact of global change on the field area.
- Field based observation of the field area.
- Intertwining personal experience and scientific knowledge to create a sense of place for the field area.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=200D
Accessed 3/29/2016

Course Number: G 200E
Course Title: Geology Field Studies: Mount St. Helens
Credit Hours: 1
Lecture Hours: 10
Lecture/Lab Hours: 0
Lab Hours: 0
Special Fee:

Course Description
Introduces basic concepts in geology through lecture and a field trip in the vicinity of Mount St. Helens. Prior geology experience recommended. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores. Audit available.

Addendum to Course Description
Geology Field Studies: Mount St. Helens (G 200 E) is a one credit course designed to engage students with the earth sciences by examining the geology of the Mount St. Helens area. The course consists of a one day field trip buttressed by supporting lectures that introduce aspects of geology as needed to explain the geology of the Mount St. Helens area. This course can be used to partly fulfill graduation requirements for the Associate Degree. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the geologic time scale and the evolution of the Earth.
Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. “Creation science”,also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that □creation science□ □ is anything other than pseudoscience.
4. Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the course
Upon completing this course, students should be able to:

A. narrate a geologic history of the Mount St. Helens region by combining site specific content knowledge with limited personal field observations and experiences within the Mount St. Helens region.

B. connect current volcanic hazard assessments of the Mount St. Helens region to the geography and geologic history of the study area.
C. communicate geologic concepts effectively using maps and diagrams in written and/or oral formats.

Course Activities and Design
The material in this course will be presented in a combination of field trip and lecture/discussion. Other educationally sound methods may be employed such as collection of field data, small group work, research papers and guest lecturers.

Outcome Assessment Strategies
At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, field trip write-ups, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a field note book.

Course Content (Themes, Concepts, Issues and Skills)

- Geologic materials and structures underlying the Mount St. Helens area.
- Internal and external processes which produced the geologic materials and structures underlying the Mount St. Helens area.
- The geologic history recorded by the geologic materials and structures underlying the Mount St. Helens area.
- Geologic hazards associated with the Mount St. Helens area.
- Geologic resources associated with the Mount St. Helens area.
- The impact of global change on the Mount St. Helens area.
- Field based observations of the Mount St. Helens area.
- Intertwining personal experience and scientific knowledge to create a sense of place for the Mount St. Helens area.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=200E
Accessed 3/29/2016

Course Number: G 200F
Course Title: Geology Field Studies: Pacific Northwest Coast
Credit Hours: 1
Lecture Hours: 10
Lecture/Lab Hours: 0
Lab Hours: 0
Special Fee:

Course Description
Introduces basic geology concepts through lecture and a field trip in the vicinity of the Pacific Northwest Coast. Prior geology experience recommended. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores. Audit available.

Addendum to Course Description
Geology Field Studies: Pacific Northwest Coast (G 200 F) is a one credit course designed to engage students with the earth sciences by examining the geology of the Pacific Northwest Coast area. The course consists of a one day field trip buttressed by supporting lectures that introduce aspects of geology as needed to explain the geology of the Pacific Northwest Coast area. This course can be used to partly fulfill graduation requirements for the Associate Degree. The text and materials have been chosen by the faculty

and the emphasis of the course will be the viewpoint of the author(s). This includes the geologic time scale and the evolution of the Earth.

Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. “Creation science”, also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that □œcreation science□☐ is anything other than pseudoscience.
4. Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the course

Upon completing this course, students should be able to:

A. narrate a geologic history of the Pacific Northwest Coast region by combining site specific content knowledge with limited field observations and experiences within the Pacific Northwest Coast region.
B. connect current coastal hazard assessments and land use concerns of the Pacific Northwest Coast region to the geography and geologic history of the Pacific Northwest Coast region.
C. communicate geologic concepts effectively using maps and diagrams in written and/or oral formats.

Course Activities and Design

The material in this course will be presented in a combination of field trip and lecture/discussion. Other educationally sound methods may be employed such as collection of field data, small group work, research papers and guest lecturers.

Outcome Assessment Strategies

At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, field trip write-ups, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a field note book.

Course Content (Themes, Concepts, Issues and Skills)

- Geologic materials and structures underlying the Pacific Northwest Coast area.
- Internal and external processes which produced the geologic materials and structures underlying the Pacific Northwest Coast area.
- The geologic history recorded by the geologic materials and structures underlying the Pacific Northwest Coast area.
- Geologic hazards associated with the Pacific Northwest Coast area.
- Geologic resources associated with the Pacific Northwest Coast area.
- The impact of global change on the Pacific Northwest Coast area.
- Field based observation of the Pacific Northwest Coast.
- Intertwining personal experience and scientific knowledge to create a sense of place for the Pacific Northwest Coast area.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=200F
Accessed 3/29/2016

Course Number: G 200G
Course Title: Geology Field Studies Columbia River Gorge
Credit Hours: 1
Lecture Hours: 10
Lecture/Lab Hours: 0
Lab Hours: 0
Special Fee:

Course Description
Introduces basic concepts in geology through lecture and a field trip in the vicinity of the Columbia River Gorge. Prior geology experience recommended. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores. Audit available.

Addendum to Course Description
Geology Field Studies: Columbia River Gorge (G 200 G) is a one credit course designed to engage students with the earth sciences by examining the geology of the Columbia River Gorge area. The course consists of a one day field trip buttressed by supporting lectures that introduce aspects of geology as needed to explain the geology of the Columbia River Gorge area. This course can be used to partly fulfill graduation requirements for the Associate Degree. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the geologic time scale and the evolution of the Earth.
Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. "Creation science", also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that □œcreation science□☐ is anything other than pseudoscience.
4. Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the course
Upon completing this course, students should be able to:

A. narrate a geologic history of the Columbia River Gorge region by combining site specific content knowledge with limited field observations and experiences within the Columbia River Gorge region.
B. connect current hazard assessments and environmental concerns affecting the Columbia River

Gorge region to the geography and geologic history of the Columbia River Gorge region.

C. communicate geologic concepts effectively using maps and diagrams in written and/or oral formats

Course Activities and Design

The material in this course will be presented in a combination of field trip and lecture/discussion. Other educationally sound methods may be employed such as collection of field data, small group work, research papers and guest lecturers.

Outcome Assessment Strategies

At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, field trip write-ups, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a field note book.

Course Content (Themes, Concepts, Issues and Skills)

- Geologic materials and structures underlying the Columbia River Gorge area.
- Internal and external processes which produced the geologic materials and structures underlying the Columbia River Gorge area.
- The geologic history recorded by the geologic materials and structures underlying the Columbia River Gorge area.
- Geologic hazards associated with the Columbia River Gorge area.
- Geologic resources associated with the Columbia River Gorge area.
- The impact of global change on the Columbia River Gorge area.
- Field based observation of the Columbia River Gorge area.
- Intertwining personal experience and scientific knowledge to create a sense of place for the Columbia River Gorge area.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=200G
Accessed 3/29/2016

Course Number: G 201
Course Title: Physical Geology
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 30
Special Fee: $12.00

Course Description
Introduces physical geology which deals with minerals, rocks, internal structure of the earth and plate tectonics. Includes weekly lab. Prerequisites: WR 115, RD 115 and MTH 95 or equivalent placement test scores. Audit available.

Addendum to Course Description
Physical Geology G 201 is intended for both geology majors and nonmajors, and is the first term of a year of beginning college geology. Physical Geology is concerned with earth materials and geologic processes acting on the earth. G 201 deals mainly with rocks and minerals, and introduces students to internally-driven geologic processes. This course can be used to partly fulfill graduation requirements for the Associate Degree, and has been approved for block transfer. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the concepts of geologic time and the evolution of the Earth.
Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1 Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2 Creation science", also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3 Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us.
4 Because "creation science", "scientific creationism", and "intelligent design" □ are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the course
A student who successfully completes this course should be able to:

- Use an understanding of rock and mineral characterization and classification to infer the geologic processes which formed individual rock and mineral specimens.
- Analyze the development, scope, and limitations of plate tectonics and utilize plate tectonics to explain the Earth□™s earthquake and volcanic activity as well as the occurrence of common

rocks, minerals, and economic deposits.
- Access earth science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of solid earth processes identifying areas of congruence and discrepancy.
- Make field and laboratory based observations and measurements of rocks and minerals and/or Earth□™s internal process, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of solid earth processes identifying areas of congruence and discrepancy.
- Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the hazards and risks posed by volcanoes and earthquakes both to themselves and society as a whole, evaluate the efficacy of possible ethically robust responses to these hazards and risks, and effectively communicate the results of this analysis to their peers.
- Assess the contributions of physical geology to our evolving understanding of global change and sustainability while placing the development of physical geology in its historical and cultural context.

Course Activities and Design
The material in this course will be presented in a combination of lecture/discussion and laboratory exercises. Other educationally sound methods may be employed such as guest lectures, field trips, research papers, and small group work.

Outcome Assessment Strategies
At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, laboratory write-ups, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a personal work journal.
Course Content (Themes, Concepts, Issues and Skills)
1. Distinguish between rocks and minerals
2. Describe the major types of materials that make up the Earth's crust and explain how each material relates to the rock cycle
3. Describe and use the properties involved in mineral identification
4. Classify commonly occurring minerals
5. Classify commonly occurring igneous, sedimentary and metamorphic rocks
6. Develop an understanding of the origin, activity, structure, and kinds of volcanoes
7. Describe the relationship of volcanoes and earthquakes to plate tectonics
8. Understand how earthquakes are generated
9. Use three earthquake records to locate the epicenter of an earthquake
10. Describe how earthquakes can be used to study the interior of the Earth
11. Discuss the evidence supporting the theory of plate tectonics
12. Examine weathering and the formation of soils (this topic may be covered in either G 201 or G 202 at the discretion of the instructor)
13. Develop an understanding of the kinds and origins or geologic structures (this topic may be covered in either G 201 or G 202 at the discretion of the instructor)
14. Examine the role of plate tectonics in shaping the surface of the Earth
15. Describe the structure and composition of the interior of the Earth

Topics to be covered include:

1. Minerals

    a. Chemistry and bonding
    b. Structure of atoms
    c. Identification (color, luster, streak, hardness, cleavage, fracture, other features)
    d. Terrestrial abundances of elements
2. Igneous Rocks
    a. Formation and crystallization of magma (partial melting, Bowen's reaction series)
    b. Classification (texture and chemistry)
    c. Intrusive rock structures (neck, dike, sill, batholith)
    d. Relationship to plate tectonics
3. Volcanoes and Volcanism
    a. Relationship between magma chemistry and gas content and type of eruption
    b. Eruptive styles (effusive vs. pyroclastic)
    c. Volcanic Features associated with basaltic volcanism (shield volcano, cinder cone, columnar jointing, fire fountaining, lava channels/tubes, pillow lavas)
    d. Volcanic Features associated with andesitic/rhyolitic volcanism (composite cones/stratovolcanoes, calderas, domes)
    e. Volcanic hazards (lahars, gas emissions)
4. Weathering (may be taught in G 202 instead)
    a. Mechanical weathering (frost wedging, abrasion, exfoliation)
    b. Chemical weathering (dissolution/solution, oxidation, hydration)
    c. Factors that affect weathering rates
    d. Products of weathering (sand, clay, iron oxides/hydroxides)
    e. Soil structure
    f. Types of soils (pedocals, pedalfers, laterites)
5. Sedimentary Rocks
    a. Sediment transport and texture (grain size and shape)
    b. Sedimentary structures (bedding (planar, graded, cross), mudcracks)
    c. Lithification (compaction and cementation)
    d. Classification of sediments (clastic/detrital: clay, silt, mud, sand, gravel vs. chemical)
    e. Classification of sedimentary rocks (clastic/detrital: shale, mudstone, siltstone, sandstone, arkose, greywacke, breccia, conglomerate vs. chemical: limestone, chert, coal, evaporates)
    f. Introduction to sedimentary depositional environments (may be left out)
6. Metamorphic Rocks
    a. Conditions promoting metamorphism (heat, pressure, fluids)
    b. Types of metamorphism (contact, regional)
    c. Causes of foliation
    d. Common metamorphic rocks (slate, phyllite, schist, gneiss, marble, quartzite, hornfels)
    e. Relationship to plate tectonics
7. Structural Geology (may be taught in G 202 instead)
    a. Stress and strain
    b. Folds (syncline, anticline, dome, basin)
    c. Faults (normal, reverse, strike-slip)
    d. Strike and dip
    e. Mountain building and relation to stress
    f. Relationship to plate tectonics
8. Earthquakes
    a. Epicenter vs. focus
    b. Seismic waves (P, S, surface)
    c. Magnitude scales vs. Intensity scale
    d. Locating an earthquake epicenter

    e. Earthquake hazards
    f. Relationship to plate tectonics
9. Earth’s Interior
    a. Chemical layers of Earth (crust, mantle core) vs. Mechanical layers (lithosphere, asthenosphere, lower mantle/mesosphere, outer core, inner core)
    b. Using seismic waves to explore Earth□™s interior
10. Plate Tectonics
    a. Alfred Wegener and evidence for continental drift
    b. Magnetic reversals and sea-floor spreading
    c. Using hot spots to determine plate motions
    d. Rifting and the origin of ocean basins
    e. Features associated with each type of plate boundary (divergent, convergent, transform)
    f. Ophiolites
    g. Subduction and related volcanism
    h. Continental collisions and relationship to mountain building
11. Convection as a driving force of plate tectonics

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=201
Accessed: 3/29/2016

Course Number: G 202
Course Title: Physical Geology
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 30
Special Fee: $12.00

Course Description
Introduces physical geology which deals with mass wasting, streams, glaciers, deserts, beaches, groundwater, and use of topographic maps. Includes weekly lab. Prerequisites: WR 115, RD 115 and MTH 95 or equivalent placement test scores. Audit available.

Addendum to Course Description
Physical Geology G 202 is intended for both geology majors and non-majors, and is the second term of a year of beginning college geology. Physical Geology is concerned with earth materials and geologic processes acting on the earth. G 202 deals mainly with surficial geologic processes. This course can be used to partly fulfill graduation requirements for the Associate Degree, and has been approved for block transfer. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the concepts of geologic time and the evolution of the Earth. Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. “Creation science”, also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that □œcreation science□☐ is anything other than pseudoscience.
4. Because “creation science”, “scientific creationism”, and “intelligent design” are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the course
A student who successfully completes this course should be able to:

- Use an understanding of landform characterization and classification to infer the geologic processes which formed specific landforms.
- Analyze how earth materials, uplift, subsidence, erosion, transport, deposition, climate, biological activity and time interact to create landscapes.

- Access earth science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of earth surface processes identifying areas of congruence and discrepancy.
- Make field and laboratory based observations and measurements of landforms and/or surface processes, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of earth surface processes identifying areas of congruence and discrepancy.
- Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the hazards and risks posed by flooding, slope processes and coastal erosion both to themselves and society as a whole, evaluate the efficacy of possible ethically robust responses to these hazards and risks, and effectively communicate the results of this analysis to their peers.
- Assess the contributions of physical geology to our evolving understanding of global change and sustainability while placing the development of physical geology in its historical and cultural context.

Course Activities and Design
The material in this course will be presented in a combination of lecture/discussion and laboratory exercises. Other educationally sound methods may be employed such as guest lectures, field trips, research papers, and small group work.

Outcome Assessment Strategies
At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, laboratory write-ups, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a personal work journal.

Course Content (Themes, Concepts, Issues and Skills)

1. Identify and classify the landforms associated with mass wasting, groundwater, streams, glaciers, deserts and shorelines
2. Understand how landforms are related to the processes of erosion, transport and deposition
3. Describe the materials that make up landforms associated with mass wasting, groundwater, streams, glaciers, deserts and shorelines
4. Examine weathering and the formation of soils (this topic may be covered in either G 201 or G 202 at the discretion of the instructor)
5. Develop an understanding of the kinds and origins or geologic structures (this topic may be covered in either G 201 or G 202 at the discretion of the instructor)
6. Examine the role of plate tectonics in shaping the surface of the Earth
7. Discuss hazards associated with mass wasting, groundwater, streams, glaciers, deserts and shorelines

Topics to be covered include:

1. Weathering (may be taught in G 201 instead)
    a. Mechanical weathering (frost wedging, abrasion, exfoliation)
    b. Chemical weathering (dissolution/solution, oxidation, hydration)
    c. Factors that affect weathering rates
    d. Products of weathering (sand, clay, iron oxides/hydroxides)
    e. Soil structure
    f. Types of soils (pedocals, pedalfers, laterites)
2. Structural Geology (may be taught in G 201 instead)

   a. Stress and strain
   b. Folds (syncline, anticline, dome, basin)
   c. Faults (normal, reverse, strike-slip)
   d. Strike and dip
   e. Mountain building and relation to stress
   f. Relationship to plate tectonics
3. Mass Movement
   a. Causes of mass movement (gravity, slope angle, angle of repose, slope composition, vegetation, water)
   b. Types of mass movement (falls, flows, slides, slumps)
   c. Features associated with mass movement (talus, evidence of creep, scarp)
   d. Prevention of mass movement
   e. Triggers (storms, earthquakes, fires, land use)
4. Streams
   a. Hydrologic cycle
   b. Stream topography (drainage basin, divide, tributaries, distributaries, gradient, graded stream)
   c. Stream erosion (base level, abrasion, hydraulic lifting, dissolution, waterfalls)
   d. Drainage patterns (dendritic, radial, rectangular, trellis)
   e. Channels (braided stream, meandering stream, cut bank, point bar, flood plain, terraces)
   f. Transport (competence, capacity, dissolved load, suspended load, bed load, saltation)
   g. Deposition (alluvial fan, delta, channel deposits, flood plains)
5. Groundwater
   a. Groundwater movement (hydraulic gradient, zone of aeration, zone of saturation, water table, porosity, permeability, aquifer, aquiclude, artesian systems)
   b. Springs and geysers
   c. Groundwater pollution/depletion (subsidence, saltwater intrusion, cone of depression)
   d. Karst topography (sinkholes, bind valleys, disappearing streams)
   e. Caves and their features (stalactites, stalagmites, soda straws, columns, dripstone/flowstone)
6. Glaciers
   a. Formation and budget of glaciers (snow to firm to glacial ice, zone of ablation/wastage, zone of accumulation, furn line/snow line)
   b. Classification of glaciers (alpine glaciers, valley glaciers, continental ice sheets)
   c. Glacial flow (plastic deformation and basal slip)
   d. Erosional features (cirque, tarn, horn, arÃªte, u-shaped valley, hanging valley, fjord)
   e. Glacial sediments and sedimentary features (drift, till, erratic, moraine, drumlin, outwash, eskers)
   f. Introduction to ice ages (evidence for past ice ages, possible causes of last ice ages)
7. Deserts
   a. Types of deserts (subtropical created by global air circulation, rain-shadow)
   b. Water erosion and deposition and related features (alluvial fan, pediment, bajada, arroyos, playa)
   c. Wind erosion and deposition and related features (deflation, deflation basins, desert pavement, ventifacts, yardangs, dunes, loess)
8. Coasts
   a. Waves (wavelength, wave base, wave motion, breaker, wave refraction, longshore current, rip current)
   b. Erosion and erosional features (headlands, wave-cut platform, marine terrace, sea cave, sea arch, sea stack)

c. Deposition and depositional features (beach, spit, berm, baymouth bar, tombolo, groins, jetties, breakwaters, barrier islands)
d. Relationship to plate tectonics (passive vs. active margins)
e. Features associated with sea level changes (estuary, fjord)

9. Causes of sea level changes (glaciers, rate of sea-floor spreading, human-induced global warming)

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=202
Accessed: 3/29/2016

Course Number: G 203
Course Title: Historical Geology
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 30
Special Fee: $12.00

Course Description
Introduces historical geology which deals with geologic time, fossils, stratigraphic principles, and the geologic history of the North American continent. Includes weekly lab. G 201 or G 202 or GS 106 strongly recommended. Prerequisites: WR 115, RD 115 and MTH 95 or equivalent placement test scores. Audit available.

Addendum to Course Description
Historical Geology is intended for both geology majors and non-majors, and is the third term of a year of beginning college geology. This course can be used to partly fulfill graduation requirements for the Associate Degree, and has been approved for block transfer. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the concepts of geologic time and the evolution of the Earth.
Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. “Creation science”, also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us.
4. Because “creation science”, “scientific creationism”, and ”intelligent design” are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the course
A student who successfully completes this course should be able to:
1. Use an understanding of sedimentary rock and fossil characterization and classification to infer the past environments recorded by specific geologic areas.
2. Analyze how relative and absolute dating have been used to construct and refine the geological time scale.
3. Use their understanding of earth systems and biological evolution to explain major events in the

geologic record.

4. Access earth science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of earth history identifying areas of congruence and discrepancy.
5. Make field and labatory based observations and measurements of landscapes, rocks and fossils, use scientific reasoning to interpret these observations and measurements, and compare the results with of current models of earth history identifying areas of congruence and discrepancy.
6. Assess the contributions of historical geology to our evolving understanding of global change and sustainability while placing the development of historical geology in its historical and cultural context.

Course Activities and Design

The material in this course will be presented in a combination of lecture/discussion and laboratory exercises. Other educationally sound methods may be employed such as guest lectures, field trips, research papers, and small group work.

Outcome Assessment Strategies

At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, laboratory write-ups, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a personal work journal.

Course Content (Themes, Concepts, Issues and Skills)

1. Discuss the evidence supporting the theory of plate tectonics
2. Explore the geologic and fossil record for each of the major geologic eons and eras
3. Discuss the evidence supporting the theory of evolution
4. Describe and use the geologic time scale
5. Explore the basic concepts involved in radiometric dating
6. Discuss the principles used in relative dating
7. Examine common invertebrate fossils

Topics to be covered include:

1. Plate Tectonics (may be covered in G 201)
   a. Alfred Wegener and evidence for continental drift
   b. Magnetic reversals and sea-floor spreading
   c. Using hot spots to determine plate motion
   d. Rifting and the origin of ocean basins
   e. Features associated with each type of plate boundary (divergent, convergent, transform)
   f. Ophiolites
   g. Subduction and related volcanism
   h. Continental collisions and relationship to mountain building
   i. Convection as a driving force of plate tectonics
2. Geologic Time
   a. Uniformitarianism
   b. Principles of relative dating (horizontality, superposition, cross-cutting relations, inclusions, faunal succession)
   c. Unconformities (angular unconformity, disconformity, nonconformity)
   d. Correlation
   e. Radiometric Dating (isotopes, half-life, parent and daughter isotopes)

f. Other absolute dating techniques (tree-rings, varves, lichenometry)
g. Geologic time scale

3. Statigraphy
    a. Stratigraphic units (formation, group, etc.)
    b. Time-rock unit
    c. Evidence for changing sea level
    d. Fossils and evidence for evolution
    e. Index fossils
4. Precambrian
    a. Divisions of Precambrian time (Hadean, Archean, Proterozoic)
    b. Formation of the Earth and Moon as members of the solar system
    c. Speculation on the conditions on the Earth during the Hadean
    d. Archean crust
    e. Origin of continents
    f. Granulite gneiss/greenstone belts
    g. Crustal provinces of North America and assembly of Laurentia and Rodinia during the Proterozoic
    h. Wilson cycles
    i. Early atmosphere
    j. Precambrian ice ages
    k. Origin of Life
    l. Indirect evidence of Life through carbon isotopes in Isua formation ~ 3.8 by ago
    m. Cyanobacteria in 3.5 by Australian cherts
    n. Stromatolites
    o. Prokaryotic vs. eukaryotic cells
    p. Ediacaran Fauna
5. Paleozoic
    a. Divisions of the Paleozoic
    b. Transgressions and Regressions (Sauk, Tippecanoe, Kaskaskia, Absaroka)
    c. Orogenies (Taconic, Caledonian, Acadian, Antler, Ouachita, Allegheny/Hercynian)
    d. Assembly of Pangea
    e. Clastic wedges
    f. Cyclothems
    g. Cambrian Explosion
    h. Burgess shale
    i. Trilobites
    j. Brachiopods vs. Mollusks
    k. Foraminifera
    l. Paleozoic Reefs (archeocyathids, corals, sponges, bryozoans)
    m. Emergence of Fish (jawless, jawed, ray- and lobe-finned)
    n. Emergence of amphibians and reptiles (amniotic egg)
    o. Plants invade land
    p. Great Permian Extinction
6. Mesozoic
    a. Divisions of the Mesozoic
    b. Orogenies (Sonoma, Nevadan, Sevier, Laramide)
    c. Breakup of Pangea
    d. Cretaceous transgression
    e. Dinosaurs, marine reptiles, and flying reptiles
    f. First birds and mammals

    g. Angiosperms (flowering and deciduous plants)
    h. K-T extinction
7. Cenozoic
    a. Divisions of the Cenozoic
    b. Alpine-Himalayan Belt
    c. Laramide orogeny
    d. Colorado Plateau
    e. Basin and Range
    f. Pleistocene ice ages
    g. Radiation of mammals
8. Human origins

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=203
Accessed: 3/29/2016

Course Number: G 207
Course Title: Geology of the Pacific Northwest
Credit Hours: 3
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 0
Special Fee:

Course Description
Introduces the regional geology of the Pacific Northwest with emphasis on Oregon geology. Includes basic geologic principles, earth materials and geology of Pacific Northwest provinces. Prior geology experience strongly recommended. Prerequisites: WR 115, RD 115 and MTH 65 or equivalent placement test scores. Audit available.

Addendum to Course Description
Geology of the Pacific Northwest (G 207) is a one-term introductory course in geology. The purpose of this course is to acquaint the student with basic geologic principles and the general geology of the Pacific Northwest. The emphasis is on the geology of Oregon and Washington. This course can be used to partly fulfill graduation requirements for the Associate Degree, and has been approved for block transfer. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the geologic time scale and the evolution of the Earth.
Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. "Creation science", also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that "creation science" is anything other than pseudoscience.
4. Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the course
A student who successfully completes this course should be able to:
1. Use an understanding of earth materials and landforms to infer the surficial and internal processes which formed the landscape and underlying geology of the physiographic provinces of the Pacific Northwest.
2. Use an understanding of plate tectonics and surficial processes to unravel the sequence of geologic

events which have acted over time to

3. create the physiographic provinces of the Pacific Northwest from diverse geologic terranes.
4. Access earth science information about the Pacific Northwest from a variety of sources, evaluate the quality of this information, and compare this information with current models of the formation and development of the physiographic provinces of the Pacific Northwest identifying areas of congruence and discrepancy.
5. Make field and laboratory based observations and measurements of earth materials and landforms, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of geological processes affecting the Pacific Northwest identifying areas of congruence and discrepancy.
6. Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the hazards and risks posed by the geological processes which are still shaping the Pacific Northwest both to themselves and society as a whole, evaluate the efficacy of possible ethically robust responses to
7. these risks, and effectively communicate the results of this analysis to their peers.
8. Assess the contributions of physical and historical geology to our evolving understanding of global change and sustainability while placing the development of the geology of the Pacific Northwest in its historical and cultural context.

Course Activities and Design

The material in this course will be presented in a lecture/discussion format Other educationally sound methods may be employed such as guest lectures, field trips, research papers, and small group work.

Outcome Assessment Strategies

At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a personal work journal.

Course Content (Themes, Concepts, Issues and Skills)

1. Locate the physiographic provinces of the Pacific Northwest on a map
2. Explore the rock types and geologic features of each of the physiographic provinces of the Pacific Northwest
3. Identify and describe the major features of the Earth's surface and interior
4. Describe the major types of materials that make up the Earth's crust and explain how each material relates to the rock cycle
5. Describe the geologic processes and features that occur at plate boundaries
6. Describe the impact of surficial processes on landscapes and geologic materials
7. Identify the role of volcanism and faulting in the development of the High Lava Plains and the Basin and Range Provinces
8. Describe the roles of flood-type volcanism, catastrophic flooding, and glaciation in the development of the Columbia Plateau
9. Compare the geologic histories of the Western Cascades, High Cascades, and North Cascades provinces
10. Discuss the formation of the Puget Sound and Willamette Valley
11. Describe the role of accretion and crustal deformation in the development of the Klamath Mountains and Blue Mountains
12. Describe the role of subduction in the development of the Coastal ranges and the Cascades
13. List the major divisions of the standard geologic time scale

Topics to be covered include:

1) Physiographic Provinces
   a) Landscape, climate, and vegetation of the PacificNorthwest
   b) Physiographic provinces of the Pacific Northwest
2) Earth's Surface Composition and Structure
   a) Regolith vs. bedrock, sources of regolith, variations in depth of regolith
   b) The three rock types; common examples, processes of formation
   c) Occurrence of rocks, cover vs. basement, horizontal vs. folded and faulted strata, types of intrusions, structure of mountain ranges, geologic maps
   d) Rock cycle; internal process vs. surficial processes, energy sources for internal and surficial processes.
   e) Continental crust vs. oceanic crust; differences in composition and thickness
3) Historical Geology
   a) Principles of relative and absolute dating
   b) Fossils, faunal succession, stratigraphic correlation
   c) Past environments; sedimentary evidence for past geographies and climates
   d) Geologic time scale
4) Plate Tectonics
   a) Basic idea of plate tectonics, evidence for plate motion, difference between continental and oceanic crust, internal structure of the earth, heat loss
   b) Creation and destruction of oceanic crust at ridges and trenches, age of oceanic crust
   c) Geologic activity and structure at each type of plate boundary (transform, convergent, divergent), cause of earthquakes, volcanism and topography at plate boundaries
   d) Hot spots, hot spot tracks, oceanic vs. continental hot spots, causes of hot spots
5) Coastal Provinces; Coast Ranges and Olympic Mountains
   a) Major topographic features, drainages, rock units and geologic structures
   b) Paleogrography of Tertiary coast
   c) Coastal processes, evidence for uplift
   d) Modern tectonic setting, accretion, evidence for prehistoric subduction zone earthquakes
6) Lowland Provinces; Puget Sound and Willamette Valley
   a) Major topographic features, drainages, rock units and geologic structures
   b) Glaciation and ice age floods
7) The Volcanic Arc: Cascade Mountains Province
   a) Major topographic features, drainages, rock units and geologic structures
   b) Subduction zone volcanism
   c) Tertiary plate tectonic setting of the Pacific Northwest
   d) Old cascades vs. young cascades, uplift of Cascade Mountains
   e) Volcanic hazards
8) Extension and Hot Spots: Basin and Range, Columbia River Plateau and High Lava Plain
   a) Major topographic features, drainages, rock units and geologic structures
   b) Timing of basin and range extension, formation of fault block mountains
   c) Flood basalt volcanism, vs. silicic volcanism
   d) Hot Spot volcanism
9) Accreted Terranes: Kalamath Mountains, Blue Mountains and North Cascades
   a) Major topographic features, drainages, rock units and geologic structures
   b) Accretion of exotic terranes, stacking of terranes, stitching by plutons
   c) Mesozoic plate tectonic setting of the Pacific Northwest
10) Edge of the Craton: Okanagan Highland and Rocky Mountains

a) Major topographic features, drainages, rock units and geologic structures
b) Cratonic sediments, fold and thrust belts
c) Paleozoic plate tectonic setting of the Pacific Northwest

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=207
Accessed: 3/29/2016

Course Number: G 208
Course Title: Volcanoes and Their Activity
Credit Hours: 3
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 0
Special Fee:

Course Description
Covers the origin, activity, products, classification and hazards of volcanoes. Prerequisites: WR 115, RD 115 and MTH 65 or equivalent placement test scores. Audit available.

Addendum to Course Description
Volcanoes and Their Activity (G 208) is a one-term introductory course in volcanology, which is a branch of the science of geology. The student will develop an understanding of the types, origin, activity, products, and hazards of volcanoes. This course can be used to partly fulfill graduation requirements for the Associate Degree, and has been approved for block transfer. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the geologic time scale and the evolution of the Earth.
Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. “Creation science”, also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that “creation science” ☐ is anything other than pseudoscience.
4. Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the course

A student who successfully completes this course should be able to:

1. Use an understanding of rock and mineral characterization and classification to infer the igneous processes which formed individual rock and mineral specimens.
2. Analyze the development, scope, and limitations of plate tectonics and utilize plate tectonics to explain the Earth’s volcanic activity, and the relationship of this activity to climate change,

agriculture, and formation of economic deposits.
3. Access volcano science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of volcanic processes identifying areas of congruence and discrepancy.
4. Make field and laboratory based observations and measurements of volcanic rocks and minerals and/or volcanic landforms, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of volcanic processes identifying areas of congruence and discrepancy.
5. Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the hazards and risks posed by volcanoes both to themselves and society as a whole, evaluate the efficacy of possible ethically robust responses to these risks, and effectively communicate the results of this analysis to their peers.
6. Assess the contributions of volcanology to our evolving understanding of global change and sustainability while placing the development of volcanology in its historical and cultural context.

Course Activities and Design
The material in this course will be presented in a lecture/discussion format Other educationally sound methods may be employed such as guest lectures, field trips, research papers, and small group work.

Outcome Assessment Strategies
At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a personal work journal.

Course Content (Themes, Concepts, Issues and Skills)
1. Describe the relationship of volcanoes to plate boundaries
2. Classify the types of rocks created by volcanic processes
3. Contrast pyroclastic and effusive eruption styles
4. Examine the effect of silica content on eruption style
5. Discuss a number of historical volcanic eruptions and determine the major cause of human destruction for each case
6. Explore the methods used to forecast volcanic eruptions
7. Classify the features that occur in volcanic landscapes
8. Define the different kinds of plutons
9. Discuss the hazards associated with the Cascade volcanoes
10. Define the following terms: shield volcano, composite volcano, cinder cone, lahar, pyroclastic flow, pahoehoe, aa
11. Discuss the effects of volcanic eruptions on climate

Topics to be covered include:
1. Global Volcanic Activity
    a. Number and geographic distribution of active volcanoes
    b. Major historic volcanic eruptions and their impact on society (e.g. Tambora, Krakatau, Vesuvius, Mount Saint Helens)
    c. Active vs. dormant vs. extinct volcanoes
2. Volcanic Eruptions
    a. Different styles of volcanic eruptions: effusive vs. explosive, Icelandic, Hawaiian, Strombolian, Vulcanian, Plinian and caldera type; lava flows, lava domes, eruption columns,

pyroclastic flows, lahars, lateral blasts, landslides

   b. Phreatic eruptions vs. magmatic eruptions; submarine eruptions; sub glacial eruptions
   c. Sizes of volcanic eruption, VEI
3. Volcanic Features
   a. Volcanic systems: volcanoes, vents, fissures and magma chambers
   b. Types of volcanoes: cinder cones, domes, shield volcanoes, stratovolcanoes, lava plateaus, calderas, maars, tuff rings
   c. Intrusive features; stocks, necks, cyptodomes, sills, dikes, plutons, batholiths.
   d. Volcanic features in the Portland area, Cascades, Columbia River Basin and eastern Oregon
4. Products of Volcanic Eruptions
   a. Chemistry of magmas: major elements and volatiles; physical properties of magmas: freezing temperature and viscosity; relationships between magma chemistry and physical properties
   b. Relationship between cooling rate and igneous rock textures
   c. Description and classification of igneous extrusive rocks: rhyolite, dacite, andesite, basalt, scoria, pumice, obsidian, vesicles, porphyritic texture
   d. Description and classification of igneous intrusive rocks: granite, granodiorite, diorite, gabbro, peridotite
   e. Lava flow features: pahoehoe vs. aa, lava tubes, cooling columns, tree casts, pillows, palagonite breccias etc.; identifying lava flow tops and bottoms in the field
   f. Pyroclastic products: ash, lapilli, cinders, bombs, tuffs, welded tuffs, flow tuffs
   g. Gases: types, quantity; sources: meteoric vs. magmatic.
   h. Lahars: dynamics, distance and speed of flow, temperature; causes
   i. Pyroclastic flows: dynamics, distance and speed of flow, temperature, deposits, causes
   j. Lateral blasts: dynamics, distance and speed of flow, temperature, deposits, causes
   k. Landslides: dynamics, distance and speed of flow, temperature, deposits, causes
5. Causes of Volcanic Eruptions
   a. Migration of magmas to shallow magma chambers, cooling and differentiation of magma chambers, differences between mafic and felsic magma chambers
   b. Role of exsolved gasses in driving volcanic eruptions
6. Plate Tectonics and Volcanism
   a. Basic idea of plate tectonics, evidence for plate motion, difference between continental and oceanic crust, internal structure of the earth, heat loss and plate tectonics
   b. Creation of oceanic crust at mid ocean ridges, volcanism and hydrothermal activity at mid ocean ridges, cause of melting at mid ocean ridges, types of magmas produced
   c. Destruction of oceanic crust at subduction zones, volcanism associated with subduction zones, cause of melting at subduction zones, types of magmas produced
   d. Hot spots and associated volcanism in oceanic and continental settings, cause of melting, types of magma produced,
   e. Relationships between tectonic setting, cause of melting, magma type produced and eruption style
7. Living with Volcanoes
   a. Volcanic hazards: lava flows, volcanic gases, eruption columns, ash falls, pyroclastic flows, lahars, landslides, lateral blasts.
   b. Volcanic hazard mapping: use of volcanic deposits to determine past eruptive behavior and frequency of volcanoes, identifying hazard zones
   c. Preparing for volcanic eruptions; personal disaster kits, volcano monitoring, evacuation plans, effective communication of scientific information, education of public
   d. Predicting volcanic eruptions: monitoring precursors (earthquakes, deformation, gas emissions): possible triggers

   e. Case studies of volcanic eruptions including successful (e.g. Mt. Pinatubo) and unsuccessful (e.g. Nevado del Ruiz) societal responses with an emphasis on Cascade volcanoes
   f. Resources associated with volcanoes: geothermal energy, hot springs, tourism, volcanic soils, mineral deposits, diamonds
8. Global Impacts of Volcanism
   a. Climate changes associated with historic eruptions, causes of these changes
   b. Flood basalt volcanism: Columbia River Basalts and other large igneous provinces
   c. Possible links between volcanism and mass extinctions
   d. Volcanic degassing as a possible source of the atmosphere and oceanSource: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=208

Accessed: 3/30/2016

Course Number: G 209
Course Title: Earthquakes
Credit Hours: 3
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 0
Special Fee:

Course Description
Covers the nature and origin of earthquakes, the characteristics of seismic waves, how earthquakes are measured, the hazards of earthquakes and the historical and geological record of earthquakes. Prerequisites: WR 115, RD 115 and MTH 65 or equivalent placement test scores. Audit available.

Addendum to Course Description
Earthquakes (G 209) is a one-term introductory course in earthquakes/seismology, which is a branch of the science of geology. The student will develop an understanding of the causes, activity, effects, and hazards of earthquakes as well as an understanding of the various methods of measuring the size/energy of an earthquake. The course will use case studies of historical earthquakes to examine ways to minimize earthquake damage, with emphasis on earthquakes in the pacific northwest. This course can be used to partly fulfill graduation requirements for the Associate Degree, and has been approved for block transfer. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the geologic time scale and the evolution of the Earth. Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
□Creation science,□☐ also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that □œcreation science□☐ is anything other than pseudoscience.
Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.
Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations in order to successfully complete this course.

Intended Outcomes for the course
A student who successfully completes this course should be able to:
1 Use an understanding of rock mechanics, paleoseismology, and the elastic rebound theory to infer the probability that an area will be seismically active.
2 Analyze the development, scope, and limitations of plate tectonics and utilize plate tectonics to explain

the Earth□™s earthquake activity.

3 Access information related to seismology from a variety of sources, evaluate the quality of this information, and compare this information with current models of seismic processes identifying areas of congruence and discrepancy.

4 Make field and laboratory based observations and measurements of earthquakes and landforms associated with earthquakes, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of seismic processes identifying areas of congruence and discrepancy.

5 Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the hazards and risks posed by earthquakes both to themselves and society as a whole, evaluate the efficacy of possible ethically robust responses to these risks, and effectively communicate the results of this analysis to their peers.

6 Assess the contributions of seismology to our evolving understanding of global change and sustainability while placing the development of seismology in its historical and cultural context.

Course Activities and Design

The material in this course will be presented in a lecture/discussion format Other educationally sound methods may be employed such as guest lectures, field trips, research papers, and small group work.

Outcome Assessment Strategies

At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a personal work journal.

Course Content (Themes, Concepts, Issues and Skills)

1 Describe what is meant by "earthquake".

2 Define the following terms: focus, epicenter, refraction, reflection.

3 Describe the different types of seismic waves.

4 Describe the relationship of earthquakes to plate tectonics.

5 Define the following terms: strain accumulation, creep, foreshock main shock, aftershock, interplate earthquake, intraplate earthquake.

6 Describe how a seismograph works.

7 Locate an earthquake epicenter using travel-time curves and three seismic records.

8 Describe how earthquakes can be used to study the interior of the Earth.

9 Locate underground faults and describe crustal structure using a seismic profile.

10 Classify the different types of faults that result from earthquakes.

11 Define the following terms: strike-slip, dip-slip, oblique-slip, hanging wall, foot wall.

12 Describe the landforms produced along faults.

13 Describe the causes of earthquakes.

14 Define the following terms: compression, dilation, elastic rebound, compressive stress, tensile stress, fault-plane diagram

15 Identify the different types of seismic waves on a seismogram and determine the motion along the fault from the first motion of the p-wave.

16 Describe the relationship between earthquakes, volcanoes and tsunamis.

17 Define the following terms: soil liquefaction, slickensides, sand boils, clastic sills.

18 Discuss a number of historical earthquakes and determine the major cause of destruction for each case.

19 Describe the events that precede earthquakes.

20 Describe the evidence for past earthquakes along the Cascadia subduction zone.

21 Describe steps that an individual can take to protect against earthquake damage
22 Describe methods for making buildings and other structures more earthquake resistant.

Topics to be covered include:

1. Global Earthquake Activity
    a. Major historic earthquakes and their impact on society (e.g. San Francisco 1906, Mexico City 1985, Nisqually 2001 etc.)
    b. Number and geographic distribution of major historic earthquakes
2. Observational Seismology
    a. Eyewitness observations during earthquakes
    b. Effects of earthquakes; ground rupture, ground displacement, fault scarps, sand boils, liquefaction, damage to buildings and structures
    c. Mercalli intensity scale
    d. Foreshocks and aftershocks
3. Faults and Earthquakes
    a. Relationship between faults and earthquakes, elastic rebound theory of earthquakes
    b. Stress (compressive, tensional, shear) and strain (brittle, ductile and elastic)
    c. Types of faults: strike slip, dip slip, oblique slip, right lateral, left lateral, normal, reverse, thrust and detachment, footwall vs. hanging wall, relation between fault type and stress
    d. Small scale features of faults; slickensides, fault gauge, mineralization.
    e. Geomorphology of faults; scarps, shutter ridges, sag ponds, linear valleys, faceted spurs
    f. Evidence for cumulative displacement along faults
    g. Causes of earthquakes not associated with faults; landslides, volcanic eruptions, atomic tests
4. Instrumental Seismology
    a. Seismometers; principles of operation, sensitivity
    b. Seismograms; identification of P, S and surface waves
    c. Properties of waves; wavelength, amplitude, period, wave speed, particle motion
    d. Behavior of waves; constructive and destructive interference, standing waves, refraction, reflection
    e. Interpretation of P, S and surface waves, typical velocities of each
    f. Use of P-S wave gap to determine distance to earthquake, pinpointing the point of origin of an earthquake by triangulation, epicenter vs. focus
    g. Use of first motion studies to determine the sense of motion along a fault, use of 'beach ball diagrams' to represent fault plane solutions
    h. Determining the magnitude of an earthquake; Richter magnitude vs. moment magnitude
    i. Frequency of various size earthquakes, depth distribution of earthquakes
5. Mechanics of Faults
    a. Creep and asperities, stick -slip models of faults
    b. Earthquakes triggered by earthquakes; changes in stress and strain caused by earthquakes
6. Earthquakes and the Earth's Internal Structure
    a. Refraction and reflection of seismic waves, application to determining subsurface structure and thickness of crust
    b. Velocity of seismic waves through different materials, effects of pressure and temperature on seismic velocity
    c. Variation of seismic velocity with depth; evidence for the low velocity zone
    d. Shadow zones as evidence for the outer and inner core.
7. Plate Tectonics and Earthquakes
    a. Basic idea of plate tectonics, evidence for plate motion, difference between continental and

oceanic crust, internal structure of the earth, heat loss and plate tectonics

   b. Types of plate boundaries: stresses associated with each, first motions of earthquakes observed at each, depths of earthquakes associated with each type of plate boundary

8. Living with Earthquakes
   a. Primary hazard from earthquakes; ground shaking, ground deformation, liquefaction
   b. Secondary hazards from earthquakes; landslides, tsunamis, fire
   c. Construction of earthquake hazard maps
   d. The methods of paleoseismology, the reoccurrence intervals of faults
   e. Preparing for earthquakes, personal preparedness, societal preparedness
   f. The design of earthquake resistant buildings, the retrofitting of existing buildings
   g. Predicting earthquakes, possible precursors, periodicity, seismic gaps
   h. Successes and failures of earthquake prediction in China and Parkfield, CA.
9. Earthquakes in the Pacific Northwest
   a. Historic earthquakes in the Pacific Northwest
   b. Tectonic setting of the Pacific Northwest and the possibility of large earthquakes
   c. Evidence for prehistoric subduction zone earthquakes in the Pacific Northwest
   d. Comparison of causes, effects and frequency of shallow, deep and subduction zone earthquakes
   e. "Silent' earthquakes in the Pacific Northwest

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=208
Accessed: 3/30/2016

Course Number: G 291
Course Title: Elements of Rocks and Minerals
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 30
Special Fee: $12.00

Course Description
Introduces the study of rocks and minerals that includes their classification, origin and identification. Prerequisites: WR 115, RD 115 and MTH 95 or equivalent placement test scores. Recommended for persons interested in rock and mineral collecting, mining and prospecting. Includes weekly lab. Audit available.

Addendum to Course Description
Elements of rocks and minerals is an introductory, one-term course for nonmajors in geology. The purpose of this course is to acquaint the student with the occurrence and mechanisms of formation of common rocks and minerals and to enable students to identify these materials in the field. This course can be used to partly fulfill graduation requirements for the Associate Degree, and has been approved for block transfer. The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes the concepts of geologic time and the evolution of the Earth. Alternative theories are of course welcome to be discussed, but the emphasis of the course shall be as stated above.

Intended Outcomes for the course

A student who successfully completes this course should be able to:

1. Use an understanding of rock and mineral characterization and classification to infer the geologic processes which formed individual rock and mineral specimens.
2. Analyze the development, scope, and limitations of plate tectonics and utilize plate tectonics to explain the occurrence and associations of common rocks, minerals, and economic deposits.
3. Access earth science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of rock and mineral forming processes identifying areas of congruence and discrepancy.
4. Make field and laboratory based observations and measurements of rocks and minerals, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of rock and mineral forming processes, identifying areas of congruence and discrepancy.
5. Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the economic and environmental benefits and risks of rock and mineral utilization both to themselves and society as a whole, and effectively communicate the results of this analysis to their peers.
6. Assess the contributions of mineralogy and petrology to our evolving understanding of global change and sustainability while placing the development of the study and utilization of rocks and minerals in its historical and cultural context

Course Activities and Design
The material in this course will be presented in a combination of lecture/discussion and laboratory exercises. Other educationally sound methods may be employed such as guest lectures, field trips, research papers, and small group work.

Outcome Assessment Strategies
At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods may include one or more of the following tools: examinations, quizzes, homework assignments, laboratory write-ups, research papers, small group problem solving of questions arising from application of course concepts and concerns to actual experience, oral presentations, or maintenance of a personal work journal.

Course Content (Themes, Concepts, Issues and Skills)

1. Distinguish between rocks, minerals and gems
2. Describe the major types of materials that make up the Earth's crust and explain how each material relates to the rock cycle
3. Describe and use the properties involved in mineral identification
4. Classify commonly occurring minerals
5. Classify commonly occurring igneous, sedimentary and metamorphic rocks
6. Understand the effect of atomic structure on the properties of minerals
7. Discuss the role of plate tectonics in the formation of minerals and rocks
8. Explore the various mechanisms for creating ore deposits
9. Describe the interaction of light with gems
10. Examine the sources and used of industrially strategic minerals and metals
    a. "Silent' earthquakes in the Pacific Northwest

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=291
Accessed: 3/30/2016

Course Number: G 298A
Course Title: Geology Independent Study
Credit Hours: 1
Lecture Hours: 10
Lecture/Lab Hours: 0
Lab Hours: 0
Special Fee:
Course Description
Provides an opportunity to work independently on an individualized area of study within geology under the sponsorship of geology faculty. Instructor permission. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores.
Intended Outcomes for the course
Upon successful completion students should be able to:

A. use the scientific method to research a geology topic with the guidance of a mentor.
B. explicate a geology topic so that it can be effectively researched in the scientific literature
C. conduct a search of the scientific literature to investigate an earth science topic
D. evaluate how a geology topic connects with current environmental and/or global change and/or sustainability concerns
E. communicate the results of geology research effectively using maps and/or diagrams in written and/or oral formats.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=298A
Accessed: 3/30/2016
Course Number: G 298B
Course Title: Geology Independent Study
Credit Hours: 2
Lecture Hours: 20
Lecture/Lab Hours: 0
Lab Hours: 0
Special Fee:
Course Description
Provides an opportunity to work independently on an individualized area of study within geology under the sponsorship of geology faculty. Instructor permission. Prerequisites: WR 115, RD 115 and MTH 20 or equivalent placement test scores.

Intended Outcomes for the course
Upon successful completion students should be able to:

A. use the scientific method to research a geology topic with the guidance of a mentor.
B. develop a geology research question by outlining a plausible research strategy and evaluating its feasibility
C. evaluate how a geology topic connects with current environmental and/or global change and/or sustainability concerns
D. communicate the results of geology research effectively using maps and/or diagrams in written and/or oral formats.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=298B
Accessed: 3/30/2016
Course Number: G 298C

Course Title: Geology Independent Study
Credit Hours: 4
Lecture Hours: 0
Lecture/Lab Hours: 80
Lab Hours: 0
Special Fee: $24.00

Course Description
Provides an opportunity to work independently on an individualized area of study within geology under the sponsorship of geology faculty. Prerequisites: Instructor permission.

Intended Outcomes for the course
Upon successful completion students should be able to:

A. use the scientific method to research a geology topic with the guidance of a mentor.
B. pursue a geology research question by collecting observations and measurements
C. evaluate how a geology topic connects with current environmental and/or global change and/or sustainability concerns
D. communicate the results of geology research effectively using maps and/or diagrams in written and/or oral formats.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=G&course=298C
Accessed: 3/30/2016

Course Number: GS 106
Course Title: Physical Science (Geology)
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 30
Special Fee: $12.00

Course Description
Covers minerals, rocks, volcanism, earthquakes, plate tectonics, erosion and deposition by wind, glaciers and streams, weathering, fossils and geologic history. Includes weekly lab. Prerequisites: WR 115, RD 115 and MTH 65 or equivalent placement test scores. Audit available.

Addendum to Course Description
The purpose of this course is to gain knowledge and appreciation of geology through lecture/discussion sessions and laboratory experiences. It is a one-term survey course that may be included as part of the years sequence in physical science for college transfer credit.
The course will have as many of the following components as feasible: lectures, discussions, lab activities, videos, slides, CDs, live television, field trips, and computer-aided instruction.

The text and materials for the course have been chosen by the faculty, and viewpoints shall be that of the author(s). This includes the topics of relativity, the geologic time scale, evolution of the Earth and its atmosphere, the solar system, the galaxy, and the universe.

Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

- Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
- “Creation science” also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
- Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that “creation science” is anything other than pseudoscience.
- Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations to successfully complete this course.

Intended Outcomes for the course

A student who successfully completes this course should be able to:

1. Use an understanding of the rock cycle, plate tectonics and surface processes to explain how the Earth's surface wears away and is renewed.
2. Use an understanding of geologic dating methods and the interpretation of geologic deposits to explain how geologists reconstruct the history of the Earth.
3. Access earth science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of geologic processes identifying areas of congruence and discrepancy.
4. Make field and laboratory based observations and measurements of earth materials and landscapes, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of geologic processes identifying areas of congruence and discrepancy.
5. Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the hazards and risks posed by geologic processes both to themselves and society as a whole, evaluate the efficacy of possible ethically robust responses to these risks, and effectively communicate the results of this analysis to their peers.
6. Assess the contributions of geology to our evolving understanding of global change and sustainability while placing the development of geology in its historical and cultural context.

Course Activities and Design

The laboratory is not separated from the lecture but will usually be correlated in such a way as to reinforce the materials being discussed in the lecture session. It is necessary for the student to successfully complete the laboratory section of the course in order to earn a grade for the course. Math will occasionally be used for solving simple ratio problems, as will be the use of maps and graphs.

Outcome Assessment Strategies

The instructor will choose from the following methods of assessment: exams, quizzes, lab exercises, written reports, oral presentations, group projects, class participation, homework assignments, and field trips. The instructor shall detail the methods being used to the students at the beginning of the course.

Course Content (Themes, Concepts, Issues and Skills)

(NOTE: the topics may be chosen in any order by the instructor)

- Explain rock and mineral classification and identification
- Explain how these materials form and how they are related to each other
- Describe the major types of landscapes that make up the Earth's surface and how they are formed
- Describe the Earth's internal structure and the processes shaping it
- Explain the relationship between the processes that shape landscapes and those that shape internal structure.
- Explain the relationship between the processes that shape landscapes and structure and those that form crustal materials
- Explain how geologic histories are constructed
- Identify the major parts of and events in the geologic calendar
- Discuss the personal and societal relevance of these topics

Topics to be covered include:

<u>Geologic materials</u>

- Minerals, Properties, classification, and chemistry
- Igneous rocks: Identification and classification
- Magmas and magmatic cooling: Volcanism and intrusion
- Sediments and weathering

- Sedimentary rocks: Identification and classification
- Lithification
- Metamorphic rocks: Identification and classification
- Metamorphism- settings and processes

Landscapes and landscaping processes
- Global topography and structure
- Topographic and geologic maps
- Mass wasting and related landscapes
- Streams and related landscapes
- Glacial systems and related landscapes
- Groundwater systems and related landscapes
- Crustal deformation and related structures (folds and faults)
- Earthquakes and plate tectonics

Historical geology
- Fossils and stratigraphy
- Relative and absolute dating techniques

Geologic time scale; major events in Earth history

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=GS&course=106
Accessed: 3/31/2016

Course Number: GS 107
Course Title: Physical Science (Astronomy)
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 30
Special Fee: $12.00

Course Description
Surveys astronomy to include historical development of the universe, Earth as a planet, Earth's moon, planets of the solar system, the sun, stars and galaxies. Includes weekly lab. Prerequisites: WR 115, RD 115 and MTH 65 or equivalent placement test scores. Audit available.

Addendum to Course Description
Physical Science (Astronomy) GS 107 is a one-term introductory course in which distance-learning methods are used together with three required four-hour laboratory meetings and a separate orientation session. The distance-learning methods include televised video and Web Course tools (WebCT). The video is accompanied by a textbook and telecourse student guide. Homework projects currently involve the use of supplemental exercises on stellar properties that require the use of a computer. In addition, students perform nighttime observations of stars and the Moon, by tracking the position of one star and the Moon over one four-hour period and over the course of a week. These observations familiarize the student with the night sky and help reinforce concepts learned in the videos and text readings. Using WebCT, students take weekly quizzes, and can easily communicate with the instructor and other students in class. A calendar module in WebCT keeps students abreast of what they should be doing when. Students can also track their scores on graded assignments using WebCT. This course can also be taught as a standard, in-class course, as are GS 106, 108, and 109 with three hours per week in lecture/discussion, and three hours per week in lab.

The text and materials have been chosen by the faculty and the emphasis of the course will be the viewpoint of the author(s). This includes relativity, the geologic time scale, and the evolution of the Earth, our solar system, our galaxy, and the universe at large.
Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. “Creation science”, also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that “creation science” is anything other than pseudoscience.
4. Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the

American Geological Institute in excluding these doctrines from our science curriculum. Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations to successfully complete this course.

Intended Outcomes for the course
A student who successfully completes this course should be able to:

1. Use an understanding of solar system models to explain the motions and phases of astronomical objects visible to the naked eye in the night sky.
2. Use an understanding of planetary, stellar, galactic and universe scale astronomical processes to assess the possibility of life existing elsewhere in the universe.
3. Access space science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of astronomical processes identifying areas of congruence and discrepancy.
4. Make field and laboratory based observations and measurements of astronomical phenomena, use scientific reasoning to interpret these observations and measurements, and compare the results with current astronomical models identifying areas of congruence and discrepancy.
5. Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the hazards and risks posed by astronomical processes both to themselves and society as a whole, evaluate the efficacy of possible ethically robust responses to these risks, and effectively communicate the results of this analysis to their peers.
6. Assess the contributions of astronomy to our evolving understanding of global change and sustainability while placing the development of astronomy in its historical and cultural context.

Course Activities and Design
The material in this course will be presented through televised video with accompanying reading assignments, in three laboratories and a required orientation session, and through supplemental computer activities. Students will be encouraged to work together on an observing project, but will be required to demonstrate mastery of the course content by taking in-class exams. Alternatively, the course can be a standard, in-class course as described above.

Outcome Assessment Strategies
At the beginning of the course, the instructor will detail the methods used to evaluate student progress and the criteria for assigning a course grade. The methods include one or more of the following tools: on-line quizzes, in-class examinations, and homework assignments, and laboratory assignments.

Course Content (Themes, Concepts, Issues and Skills)
1. Describe astronomical distance and size scales.
2. Describe the apparent motion of astronomical objects (planets, stars) caused by the rotation and revolution of the Earth.
3. Describe the historical development of astronomy.
4. Describe the properties of light.
5. Describe the properties of the sun and other stars.
6. Describe how stars evolve.
7. Describe the properties of the Milky Way galaxy and other galaxies.
8. Describe the global properties of various planets in the solar system, including the Earth and it's moon.
9. Describe the properties of meteorites, comets, and asteroids.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=GS&course=107
Accessed: 3/31/2016

Course Number: GS 108
Course Title: Physical Science (Oceanography)
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 30
Special Fee: $12.00

Course Description
Includes the chemical, biological, physical and geological nature of the oceans. Includes weekly lab. Prerequisites: WR 115, RD 115 and MTH 65 or equivalent placement test scores. Audit available.

Addendum to Course Description
The purpose of this course is to develop an understanding of the chemical, biological, physical, and geological processes related to the ocean, and include historical perspectives. It is a one-term survey course that may be included as part of the year's sequence in physical science for college transfer credit. The course will have as many of the following components as feasible: lectures, discussions, lab activities, videos, CDs, slides, and computer aided instruction. It is necessary to successfully complete the lab part of the course in order to pass the course.

The faculty has chosen the text and lab materials and the viewpoints shall be that of the author(s). This includes the topics of relativity, the geologic time scale, and the evolution of the Earth, solar system, and the galaxy and universe.
Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

- Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
- "Creation science", also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
- Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that "creation science" is anything other than pseudoscience.
- Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations to successfully complete this course.

Intended Outcomes for the course

A student who successfully completes this course should be able to:

1. Use an understanding of waves, tides, and coastal processes to explain the development and functioning of beaches, shorelines and estuaries.
2. Use an understanding of ocean structure and processes to explain the spatial and temporal distribution of biological productivity in the world ocean.
3. Access ocean science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of ocean processes identifying areas of congruence and discrepancy.
4. Make field and laboratory based observations and measurements of ocean materials and marine processes, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of ocean processes identifying areas of congruence and discrepancy.
5. Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the hazards and risks posed by ocean processes both to themselves and society as a whole, evaluate the efficacy of possible ethically robust responses to these risks, and effectively communicate the results of this analysis to their peers.
6. Assess the contributions of oceanography to our evolving understanding of global change and sustainability while placing the development of oceanography in its historical and cultural context.

Course Activities and Design
The laboratory is not separate from the lecture, but will usually be correlated in such a way as to reinforce the materials being discussed in the lecture section. It is necessary for the student to successfully complete the laboratory portion of the course in order to earn a grade in the course. Math will be used to solve ratio, percentage, and simple algebraic problems. Also included are the designing, reading, and interpreting of graphs.

Outcome Assessment Strategies
The instructor will choose from the following methods of assessment: exams, quizzes, lab exercises, written reports, oral reports, group projects, class participation, homework assignments, and field trips. The instructor shall detail the methods to be used to the students at the beginning of the class.

Course Content (Themes, Concepts, Issues and Skills)
(note: topics may be selected in any order by each instructor)

- Explain the nature and history of oceanography as a science
- Discuss the structure and evolution of the Earth's ocean basins and coastlines.
- Discuss the mechanics of waves, currents, and tides
- Describe the major chemical and physical properties of seawater and the interaction of these properties.
- Discuss marine biology in terms of habitats and zones, life in the oceans.
- Discuss how humans impact the marine environment in terms of resources from the sea and marine pollution.
- Other topics as desired by the instructor.

Topics to be covered include:
<u>Oceanography as a science</u>
- The scientific method as it applies to oceanography
- Major divisions of oceanography

- Brief history of oceanography

Marine geology

- Major seafloor features and bathymetric mapping
- The Earth's internal structure and structure of oceanic crust
- Surficial processes related to the oceans: Mass wasting, stream flow, groundwater, glaciers, wind, waves, and ocean currents
- Tectonic processes related to the oceans: Volcanism, crustal deformation, and plate tectonics.
- Major rock types
- Seafloor sediment: Classification, formation, and distribution

Physical oceanography

- Seawater - Physical properties, measurement, and geography
- Surface and deep ocean currents: Mechanics, measurement, and geography
- Waves: Basics physics and types
- Tides: Mechanics, measurement, and prediction

Marine biology

- Marine organisms and adaptation
- Marine organisms and ecological relationships: Food webs, energy flow, and populations
- Marine environments: Types, physical conditions, inhabitants and adaptations, ecological relationships.
- Human impact: The impact of resource extraction from and contamination of marine environments.

Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=GS&course=108
Accessed: 3/31/2016

Course Number: GS 109
Course Title: Physical Science (Meteorology)
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 0
Lab Hours: 30
Special Fee: $12.00

Course Description
Covers characteristics of our atmosphere, air pressure and winds, atmospheric moisture, large air masses, violent storms, the effect of oceans on weather, and climates. Includes weekly lab. Prerequisites: WR 115, RD 115 and MTH 65 or equivalent placement test scores. Audit available.

Addendum to Course Description
The purpose of this course is to develop an understanding of our atmosphere, weather, and climate, including historical perspectives. It is a one-term survey course that may be included as part of the year's sequence in physical science for college transfer credit.

The course will have as many of the following components as feasible: lectures, discussions, lab activities, videos, CD's, slides, live television and computer reports, and computer-aided instruction. It is necessary to successfully complete the lab part of the course in order to pass the course.

The text and materials for this course have been chosen by the faculty and viewpoints shall be that of the author(s). This includes the topics of relativity, the geologic time scale, evolution of the Earth and its atmosphere, the solar system, the galaxy and the universe.
Regarding the teaching of basic geologic principles (such as geologic time and the theory of evolution), the Portland Community College Geology Department stands by the following statements about what is science.

1. Science is a fundamentally non-dogmatic and self-correcting investigatory process. A scientific theory is neither a guess, dogma, nor myth. The theories developed through scientific investigation are not decided in advance, but can be and often are modified and revised through observation and experimentation.
2. œCreation science", also known as scientific creationism, is not considered a legitimate science, but a form of religious advocacy. This position is established by legal precedence (Webster v. New Lenox School District #122, 917 F.2d 1004).
3. Geology instructors at Portland Community College will teach the generally accepted basic geologic principles (such as geologic time and the theory of evolution) not as absolute truth, but as the most widely accepted explanation for our observations of the world around us. Instructors will not teach that "creation science" is anything other than pseudoscience.
4. Because "creation science", "scientific creationism", and "intelligent design" are essentially religious doctrines that are at odds with open scientific inquiry, the Geology/General Sciences SAC at Portland Community College stands with such organizations such as the National Association of Geoscience Teachers, the American Geophysical Union, the Geological Society of America, and the American Geological Institute in excluding these doctrines from our science curriculum.

Students are expected to be able to read and comprehend college-level science texts and perform basic mathematical operations to successfully complete this course.

Intended Outcomes for the course

A student who successfully completes this course should be able to:

1. Use an understanding of atmospheric processes to elucidate the practice of weather prediction.
2. Use an understanding of atmospheric structure and global circulation to explain the climates of the Earth.
3. Access atmosphere science information from a variety of sources, evaluate the quality of this information, and compare this information with current models of meteorological processes identifying areas of congruence and discrepancy.
4. Make field and laboratory based observations and measurements of the atmosphere, weather, and climate, use scientific reasoning to interpret these observations and measurements, and compare the results with current models of meteorological processes identifying areas of congruence and discrepancy.
5. Use scientifically valid modes of inquiry, individually and collaboratively, to critically evaluate the hazards and risks posed by meteorological processes both to themselves and society as a whole, evaluate the efficacy of possible ethically robust responses to these risks, and effectively communicate the results of this analysis to their peers.
6. Assess the contributions of meteorology to our evolving understanding of global change and sustainability while placing the development of meteorology in its historical and cultural context.

Course Activities and Design

The laboratory is not separate from the lecture, but will usually be correlated in such a way as to reinforce the materials being discussed in the lecture section. It is necessary for the student to successfully complete the laboratory section of the course in order to earn a grade in the course. Math will be used to solve ratio, percentage, and simple algebraic problems. Also included are the design, reading, and interpreting of graphs.

Outcome Assessment Strategies

The instructor will choose from the following methods of assessment: exams, quizzes, lab exercises, written reports, oral presentations, group projects, class participation, homework assignments, and field trips. The instructor shall detail the methods to be used to the students at the beginning of the course.

Course Content (Themes, Concepts, Issues and Skills)

1. Explain the nature and history of meteorology as a science
2. Discuss the structure and dynamics of the Earth's atmosphere.
3. Discuss the basic physical principles of energy
4. Explain how solar and gravitational energy drive weather
5. Describe the different facets of the hydrologic cycle and atmospheric circulation
6. Outline the details of weather observation
7. Discuss weather systems and major theories used to explain and predict the behavior of these systems
8. Outline the details of weather forecasting
9. Discuss climate, climate zones, and the factors that shape them
10. Explain how and why climate changes
11. Discuss humans impact weather and climate change
12. Other topics as desired by the instructor.

Meteorology as a science

1. The scientific method as it applies to meteorology
2. Major divisions and activities of meteorology
3. Short history of meteorology

Atmospheric basics

1. Physical and chemical properties of air
2. Structure of the atmosphere
3. Energy flow and dynamics of the atmosphere

Basics of weather

1. Physics of energy: States and forms of energy, energy conversions, and types and behavior of radiant energy.
2. Flow of energy through the atmosphere
3. Heat and temperature: Basic physics, measurement, and temporal and geographic variation
4. Physics and chemistry of water
5. Water cycling within the atmosphere
6. Humidity
7. Clouds, cloud formation, and precipitation
8. Physics of air: Air pressure and density
9. Movement of air within the atmosphere
10. Measuring and mapping air pressure and winds
11. Types of winds : Micro, meso, global scale

Weather systems

1. Typical global and regional weather patterns
2. Systems, theory, and modeling
3. Global atmospheric circulation within the troposphere
4. Air mass characteristics and development
5. Weather front characteristics and behavior
6. Mid-latitude and tropical cyclone characteristics and development

Weather forecasting
1 Weather data gathering and organization
2 Forecast techniques

Climate and climate change
Source: http://www.pcc.edu/ccog/default.cfm?fa=ccog&subject=GS&course=109
Accessed: 3/31/2016

APPENDIX 2
G/GS Core Mapping Matrix and Legend

Table 2.1 – Core Outcome Mapping Matrix Legend

Mapping Level Indicators		PCC Core Outcomes
0: Not Applicable.		CO1. Communication
1: Limited demonstration or application of knowledge and skills.		CO2. Community and Environmental Responsibility
2: Basic demonstration and application of knowledge and skills.		CO3. Critical Thinking and Problem Solving
3: Demonstrated comprehension and is able to apply essential knowledge and skills.		CO4. Cultural Awareness
4: Demonstrates thorough, effective and/or sophisticated application of knowledge and skills.		CO5. Professional Competence
		CO6. Self-Reflection

Table 2.2 – 2016 Core Outcome Mapping Matrix

Course #	Course Name	CO1	CO2	CO3	CO4	CO5	CO6
GS 106	Physical Science (Geology)	4	3	4	1	2	1
GS 107	Physical Science (Astronomy)	4	3	4	1	2	1
GS 108	Physical Science (Oceanography)	4	3	4	1	2	1
GS 109	Physical Science (Meteorology)	4	3	4	1	2	1
G 148	Volcanoes and Earthquakes	4	4	4	2	2	2
G 160	Geology: Oregon Coast	4	2	4	1	2	3
G 161	Geology: Great Basin/Cascades	4	2	4	1	2	3
G 184	Global Climate Change	4	4	4	2	2	2
G 200D	Prin of Geology: Field Geology - 1 cr	3	3	4	2	1	0
G 200A	Prin of Geology: Field Geology - 2 cr	4	4	4	2	2	2
G 200B	Prin of Geology: Field Geology - 4 cr	4	4	4	2	2	2
G 200C	Prin of Geology: Field Geology - 6 cr	4	4	4	2	2	2
G 200E	Geology Field Studies: Mt. St. Helens	4	4	4	2	2	2
G 200F	Geology Field Studies: Pacific NW Coast	4	4	4	2	2	2
G 200G	Geology Field Studies: Columbia River Gorge	4	4	4	2	2	2
G 201	Physical Geology	4	3	4	1	2	2
G 202	Physical Geology	4	4	4	1	2	2
G 203	Historical Geology	4	2	4	1	2	2
G 207	Geology of the Pacific Northwest	3	2	4	2	2	2
G 208	Volcanoes and Their Activity	3	3	4	2	2	2
G 209	Earthquakes	3	3	4	2	2	2
G 291	Elements of Rocks and Minerals	4	3	4	1	2	2
G 298A	Geology Independent Study - 1 cr	4	2	4	1	3	3
G 298B	Geology Independent Study - 2 cr	4	2	4	1	3	3
G 298C	Geology Independent Study - 4 cr	4	2	4	1	3	3

APPENDIX 3
Mass Wasting Assessment Project

G 202 Mass Wasting Project 2016

The landscape that surrounds you every day was created by a variety of geological processes. For this project, you are going to focus on the process of mass wasting. Each student will locate, describe, identify and interpret **three landforms** created by mass wasting, and then assess the risk and community responsibility associated with each landform. The goal of this project is for you to look at the world around you with new "geologic" eyes, and to begin thinking about risks and the costs (financial, personal, and environmental) of dealing with those risks.

Some important requirements:

- Images and information for the project must be obtained during Winter term 2016 from the Portland area (can include the Coast, Mt. Hood, and Mt. St. Helens areas).
- Each student must turn in their own work (images, sketches, text). Passing off someone else's work as your own is known as plagiarism and will result in you receiving a zero for the project. You are encouraged to carpool with others, both to make the experience more enjoyable, to save energy/money, and for safety (the driver shouldn't be looking at a roadside while driving).
- Each student must provide proof that they went where they went. This may be in the form of having someone photograph you in the field at each site.

Key stages in the project:

- Go out into the field and document three features (see information under "Write-Up" below).
- Use scientifically credible resources (do some research) about your features/topic
- Write a field journal (see information about contents under "Write Up"). The paper must be typed with one inch margins all around, using a 10 or 12 pt. legible font and be doubled spaced.

Choosing Landforms:

- You will need to find three different landforms. At least one of these three features must include a hazard mitigation feature (you may include more, but at least one has to be a hazard mitigation feature).
- There are lots of acceptable landforms to choose from. Here is a partial list (it is by no means complete): Evidence of creep, Scarp, Slump block, Talus slopes (See chapter 16 in Marshak).

Write-Up:
Your write up for this project should consist of four sections:

- **Introduction:** In this section you should provide the reader with information about your approach to this project. This could include:
    1. How you went about finding your landforms. Some students just get in the car and drive, while others do background research before starting out.
    2. When and with whom you went. Include some personal reflection, as this should be a journal. Things such as "first it sleeted, then it snowed, then the sun came out and it was gorgeous" would be appropriate here.
- **Landform Description:** Start each landform description on a new page. Some of the content you might want to include would be:
    1. Identify
       a) describe and classify
       b) document (labeled sketch or photograph—and you do need figure captions—you should provide some indication of scale).
    2. Locate
       a) Locate on a map **(REQUIRED and reference the map**)
       b) verbal description (may include elevation, surrounding landforms, slope, exposure, etc.).
    3. Interpret
       a) describe the processes which created the landform
       b) discuss the evolution of the landform through time (either verbally or with the aid of sketches)
       c) relate the landform to factors which control its formation, such as topography, substrate, climate, etc.
    4. Assess Hazard and Risk
       a) Describe possible hazards associated with your landforms, assess the magnitude of those hazards, and evaluate what of value is put at risk by those hazards
       b) What if anything is being done to manage any hazards associated with your landforms?
- **Conclusions:** Summarize your project. Some things you might want to include are:
    1. Reflect on what you learned about the landscape around you and how your views about the area in which you live have changed.
    2. Discuss your experience out in the field, particularly if you went with others. Talk about how you interacted and what you were doing/discussing.
    3. Discuss the roles of individuals and governments in hazard mitigation. Think about the possible magnitudes of the hazards and the costs associated with mitigation efforts. Who should pay for it? Does your answer depend on whether someone knew or didn't know about a potential hazard before being affected by it?
    4. Cultural Response to Landslides. How do cultures respond to landslides? How does our culture respond? How do other cultures respond? **Use the Tumbi landslide in Papua New Guinea as a case study to examine these questions.** Suppose a similar landslide had

occurred in the Coast Range of Oregon and was associated with an effort to build an LNG terminal. How would the societal response in Oregon compare to that in Papua New Guinea? How would it have been similar, how would it have differed?

Tumbi Quarry Landslide Papua New Guinea Case Study

On January 24th 2012 a kilometer long landslide in the remote southern highlands of Papua New Guinea near Tari killed an estimated 60 people. The cause of the landslide is under debate. Heavy rain and blasting in an adjacent quarry in the week prior to the landslide have been cited as probable causes. The adjacent quarry is part of a major Liquid Natural Gas (LNG) project run by Exxon.

Suggested References for Tumbi Case Study
An initial video from ABC Australia:
http://www.abc.net.au/news/2012-01-24/fears-for-missing-after-landslide-in-png-highlands/3790914
A report by the National Disaster Council of Papua New Guinea
http://www.pacificdisaster.net/pdnadmin/data/original/PNG_2012_LS_assessmnt_rprt.pdf
A series of blog post from Dr. Dave Petley who studies Environmental Hazards at Durham Uiversity in the UK
http://blogs.agu.org/landslideblog/?s=tumbi&submit_x=0&submit_y=0&mswhere=blog
A series of blog post from LNG Watch a Papua New Guinea watch dog organization.
http://lngwatchpng.blogspot.com/search?q=tumbi&max-results=20&by-date=true

- **References:** You should have a list of references which correspond to references sprinkled throughout the body of your paper. Any reader should be able to quickly locate any image or piece of information that is not your own.

Landform Description (Expanded)

For each landform make sure to address the main headings, the sub headings are suggestions on how to do this and may not apply for each landform you identify.

- Locate Landform
  - verbally
  - longitude & latitude (use a GPS unit or Google Earth)
  - on a map
  - elevation
  - lay of the land in which the landform occurs
  - slope
  - exposure
- Describe Landform
  - verbally
  - quantitatively
  - visually (labeled sketch or photo) REQUIRED FIGURE
- Identify Landform
  - classify and name
  - describe characteristic of landform which justify its classification and naming
- Interpret Landform
  - describe processes which created landform
  - relate to factors which control landform creation (substrate, topography, agent of erosion and deposition, climate, biology, and time)
  - illustrate evolution of landform using a sequence of labeled sketches
- Asses Hazard & Risk
  - describe possible hazards
  - asses magnitude of hazards
  - describe possible triggers
  - evaluate what of value is put at risk by hazard
- Evaluate Risk Management
  - How is the risk currently being managed?
  - evaluate current risk management
  - suggest improvements in risk management

APPENDIX 4
Rubric for the Mass Wasting Assessment Project

G 202 Landscape Project 2015-2016 Learning Objectives
1. Identify, describe and classify landforms in the environment.
2. Infer the geologic process which created a specific landform and describe how this process created the landform over time and will continue to shape the landform in the future.
3. Evaluate how human activity has impacted the development of a landform and/or how the landform and the processes which create the landform impact human land use in the vicinity of the landform.
4. Identify a structure designed to manage risk associated with a landscape forming processes, identify the hazard creating risk and what of value is put at risk. Explain how the structure manages risk.
5. Evaluate how a landform and the processes which create the landform impact the surrounding community and how the community responds to this impact.
6. Produce a clearly organized text written in coherent and effective prose using standard English conventions which incorporates properly referenced scientific data and information.
7. Use photographs, diagrams and maps to clearly document and interpret landforms.
8. Read earth science documents, extract information relevant to this project, evaluate the scientific validity of this information and apply this information to interpreting landforms.
~~**9. Critically read and evaluate a peer's landscape project, and then give constructive feedback identifying specific ways the project could be improved.**~~
~~**10. Use peer and instructor feedback to improve clarity, coherence and effectiveness of the landscape project.**~~
11. Describe the approach and methodology used to select the landforms for this project.
12. Demonstrate a personal voice when reflecting upon how this project has altered their view of the physical environment.
13. Identify how your own culture understands natural hazards, responds to natural hazards and rationalizes its response to natural hazards
14. Identify how a culture other than your own understands natural hazards, responds to natural hazards and rationalizes its response to natural hazards.
15. Reflect on what you learned while working on this project and self-assess to what degree your project met the project goals.
16. Identify how your own personal attitudes towards natural hazards changed during this project and analyze what caused those attitudes to change.

G 202 Landscape Project Scoring Rubric 2015/16				
Learning Objective	**Level 4**	**Level 3**	**Level 2**	**Level 1**
1. Identify, describe and classify landforms in the environment.	All landforms are identified clearly, described accurately and classified correctly. Landforms descriptions are specific and detailed.	Most landforms are identified clearly, described accurately and classified correctly. Landform descriptions are somewhat specific and include some detail.	Some landforms are identified clearly, described accurately and classified correctly. Landform descriptions are generic and lack specific details.	Landforms are not identified clearly, described vaguely if at all, and classified incorrectly or not classified. Landform descriptions are fragmentary and hard to follow.
2. Infer the geologic process which created a specific landform and describe how this process created the landform over time and will continue to shape the landform in the future.	In all cases the processes which created a landform are inferred correctly. Process descriptions are complete and specific to an individual landform and its surroundings. Past and future changes of all the landforms are correctly and clearly described and/or illustrated.	In most cases the processes which created a landform are inferred correctly. Process descriptions are mostly complete and somewhat specific. Past and future changes of most of the landforms are correctly and clearly described and/or illustrated.	In some cases the processes which created a landform are inferred correctly. Process descriptions are incomplete and generic. The process descriptions could apply to any example of the landform. Past and future changes of some of the landforms are correctly and clearly described and/or illustrated.	Processes which created a landform are not inferred correctly or not inferred at all. Process descriptions are fragmentary and hard to follow. There is no description of how the landform has changed over time.

G 202 Landscape Project Scoring Rubric 2011/12				
Learning Objective	**Level 4**	**Level 3**	**Level 2**	**Level 1**
3. Evaluate how human activity has impacted the development of a landform and/or how the landform and the processes which create the landform impact human land use in the vicinity of the landform.	In all cases the human impact on the development of the land form is clearly and accurately evaluated. In all cases the impact of the landform and its associated land forming processes on human land use is clearly and accurately evaluated.	In most cases the human impact on the development of the land form is clearly and accurately evaluated. In most cases the impact of the landform and its associated land forming processes on human land use is clearly and accurately evaluated.	In some cases the human impact on the development of the land form is clearly and accurately evaluated. In some cases the impact of the landform and its associated land forming processes on human land use is clearly and accurately evaluated.	The human impact on the development of the land forms is incorrectly evaluated or not evaluated. The impact of the landform and it associated land forming processes is incorrectly evaluated or not evaluated.
4. Identify a structure designed to manage risk associated with a landscape forming processes, identify the hazard creating risk and what of value is put at risk. Explain how the structure manages risk.	The structure managing risk is clearly identified and clearly and specifically linked to the land forming hazard it manages. What of value is protected by the structure is clearly and specifically identified. How the structure operates to manage risk is clearly and specifically explained.	The structure managing risk is somewhat clearly identified and linked to the land forming hazard it manages in a general way. What of value is protected by the structure is identified in a general way. How the structure manages risk is explained in a general way.	The structure managing risk is poorly identified and vaguely linked to the land forming hazard it manages. What of value is protected by the structure is vaguely identified. How the structure manages risk is vaguely explained.	The structure managing risk is vaguely identified or not at all, no links are made between the structure, landscape forming processes, risk, hazard and value. How the structure operates to manage risk is incorrectly explained or not explained at all.

G 202 Landscape Project Scoring Rubric 2011/12				
Learning Objective	**Level 4**	**Level 3**	**Level 2**	**Level 1**
5. Evaluate how a landform and the processes which create the landform impact the surrounding community and how the community responds to this impact.	In all cases the impact of the landform and the associated landscape processes on the surrounding community and the community's response to this impact are clearly and completely evaluated.	In most cases the impact of the landform and the associated landscape processes on the surrounding community and the community's response to this impact are clearly and completely evaluated.	In some cases the impact of the landform and the associated landscape processes on the surrounding community and the community's response to this impact are clearly and completely evaluated.	The impact of the landform and the associated landscape processes on the surrounding community and the community's response to this impact are not evaluated.
6. Produce a clearly organized text written in coherent and effective prose using standard English conventions which incorporates properly referenced scientific data and information.	The project is well organized, written in effective prose with no or only a few errors of usage, and is well supported by appropriate scientific data and information.	The project is adequately organized, written in clear prose with some errors of usage, and incorporates some scientific data and information.	The project is poorly organized, written in hard to follow prose littered with frequent errors of usage, and incorporates very little scientific data and information.	The project is unorganized, unintelligible and lacks scientific data and information.
7. Use photographs, diagrams and maps to clearly document and interpret landforms.	In all cases the landform and its associated landscape forming processes are clearly described using graphical documentation which clearly indicates scale and accurately locates the landform.	In most cases the landform and its associated landscape forming processes are clearly described using graphical documentation which clearly indicates scale and accurately locates the landform.	In some cases the landform and its associated landscape forming processes are clearly described using graphical documentation which clearly indicates scale and accurately locates the landform.	Graphical documentation of the landforms and their associated landscape forming processes is unclear or missing.

G 202 Landscape Project Scoring Rubric 2011/12				
Learning Objective	**Level 4**	**Level 3**	**Level 2**	**Level 1**
8. Read earth science documents, extract information relevant to this project, evaluate the scientific validity of this information and apply this information to interpreting landforms.	The information from earth science documents which has been incorporated into the project is relevant, valid and correctly applied to the analysis of landforms.	The information from earth science documents which has been incorporated into the project is generic, somewhat valid and somewhat correctly applied to the analysis of landforms.	The information from earth science documents which has been incorporated into the project is not relevant, of suspect validity and incorrectly applied to the analysis of landforms.	No information from earth science documents has been incorporated into the project.
~~**9. Critically read and evaluate a peer's landscape project, and then give constructive feedback identifying specific ways the project could be improved.**~~	The peer evaluation identifies specific shortcomings and weaknesses, and gives constructive suggestions for improvement.	The peer evaluation identifies generic shortcomings and weaknesses, and gives general suggestions for improvement.	The peer evaluation identifies few if any shortcomings and weaknesses, and then gives only vague suggestions for improvement.	The peer evaluation identifies fails to identify any shortcomings and weaknesses, and gives no suggestions for improvement.
~~**10. Use peer and instructor feedback to improve clarity, coherence and effectiveness of the landscape project.**~~	The rewrite of the project effectively addresses all the shortcomings and weaknesses identified the peer review.	The rewrite of the project effectively addresses many of the shortcomings and weaknesses identified the peer review.	The rewrite of the project addresses few of the shortcomings and weaknesses identified the peer review.	The rewrite of the project does not address the shortcomings and weaknesses identified the peer review.

G 202 Landscape Project Scoring Rubric 2011/12				
Learning Objective	**Level 4**	**Level 3**	**Level 2**	**Level 1**
11. Describe the approach and methodology used to select the landforms for this project.	The method used to select landforms for this project is clearly explained.	The method used to select landforms for this project is partially explained.	The method used to select landforms for this project is vaguely explained.	The method used to select landforms is incoherently explained or not explained at all.
12. Demonstrate a personal voice when reflecting upon how this project has altered their view of the physical environment.	The voice used in reflecting upon how this project has altered their view of the physical environment is lively and idiosyncratic.	The voice used in reflecting upon how this project has altered their view of the physical environment displays some personality but is not fully developed.	The voice used when reflecting upon how this project has altered their view of the physical environment is generic and banal.	There is no clear or consistent voice used when reflecting upon how this project has altered their view of the physical environment.

G 202 Landscape Project Scoring Rubric 2011/12				
Learning Objective	**Level 4**	**Level 3**	**Level 2**	**Level 1**
13. Identify how your own culture understands natural hazards, responds to natural hazards and rationalizes its response to natural hazards.	The culture's attitude towards natural hazards is incisively identified and fully explicated.	The culture's attitude towards natural hazards is identified and explicated.	The culture's attitude towards natural hazards is partially identified and partially explicated.	The culture's attitude towards natural hazards is not identified and is not explicated.
14. Identify how a culture other than your own understands natural hazards, responds to natural hazards and rationalizes its response to natural hazards.	The culture's attitude towards natural hazards is incisively identified and fully explicated.	The culture's attitude towards natural hazards is identified and explicated.	The culture's attitude towards natural hazards is partially identified and partially explicated.	The culture's attitude towards natural hazards is not identified and is not explicated.

G 202 Landscape Project Scoring Rubric 2011/12				
Learning Objective	**Level 4**	**Level 3**	**Level 2**	**Level 1**
15. Reflect on what you learned while working on this project and self-assess to what degree your project met the project goals.	Personal learning is thoroughly identified and fully explained. Attainment of project goals is clearly, thoroughly and accurately assessed.	Personal learning is identified and explained. Attainment of project goals is assessed.	Personal learning is vaguely identified and explained in a confusing manner. Project goals are assessed in an incomplete and or confusing manner.	There is no identification of personal learning. There is no assessment of the attainment of the project goals.
16. Identify how your own personal attitudes towards natural hazards changed during this project and analyze what caused those attitudes to change.	Changes in personal attitudes towards natural hazards are thoroughly identified and are clearly linked to causes.	Changes in personal attitudes towards natural hazards are identified and are linked to causes.	Changes in personal attitudes towards natural hazards are vaguely identified and only partially linked to causes.	There is no clear identification of changes in personal attitudes towards natural hazards.

APPENDIX 5
Pre-test & Post-test Survey – Internal Processes
(GS 106, G 148, G 201, G 207, & G 208)

The results of this assessment survey will be analyzed by an evaluator other than your class instructor. The results will have no bearing on your final grade for the class.

1. What is the 5 digit course number (CRN) for this class?

- ○ 10619 : RC / TuTh 6:30 - 9:20
- ○ 10997 : RC / TuTh 3:30 - 6:20
- ○ 12235 : SY / WF 12:00 - 2:50
- ○ 13423 : CA / TuTh 1:00 - 3:50
- ○ 14290 : SY / MW 8:30 - 11:20

2. Please enter your first and last name in the spaces provided.

First [ ]

Last [ ]

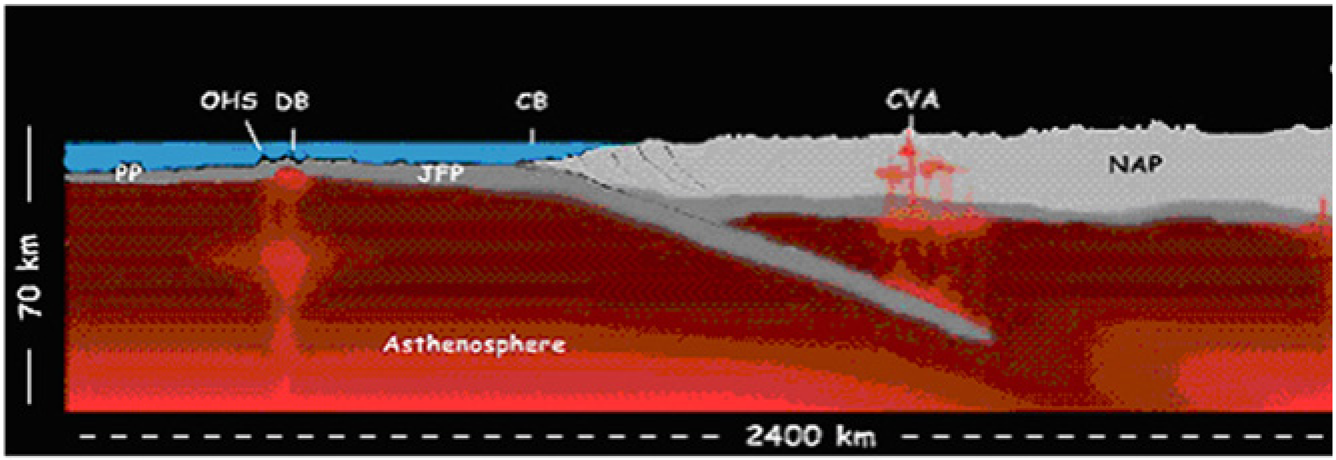
3. After taking this course my interest in geology has increased.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

4. My understanding of geology contributes to my world view and how I make decisions as a citizen.

- ○ Strongly Agree
- ○ Agree
- ○ Neutral
- ○ Disagree
- ○ Strongly Disagree

Figure 1



5. Figure 1 is a cross section of the Earth's crust and upper mantle. What is happening at the place marked DB?

- Oceanic crust is being pulled apart, resulting in volcanic activity on the seafloor
- Oceanic crust is colliding, creating a ridge and volcanic activity
- Seafloor is being subducted under the continent
- Volcanic activity is caused by continental crust riding over the top of a plume of hot rising rock in the upper mantle
- Oceanic crust is being destroyed
- I don't know enough about this to make an educated guess

6. What is happening in the area marked CB?

- Oceanic crust is being pulled apart, resulting in volcanic activity on the seafloor
- Oceanic crust is colliding, creating a ridge and volcanic activity
- Seafloor sediment is being scraped off subducting seafloor
- Volcanic activity is caused by continental crust riding over the top of a plume of hot rising rock in the upper mantle
- Oceanic crust is being created
- I don't know enough about this to make an educated guess

7. In Figure 1, how many tectonic plates are illustrated?

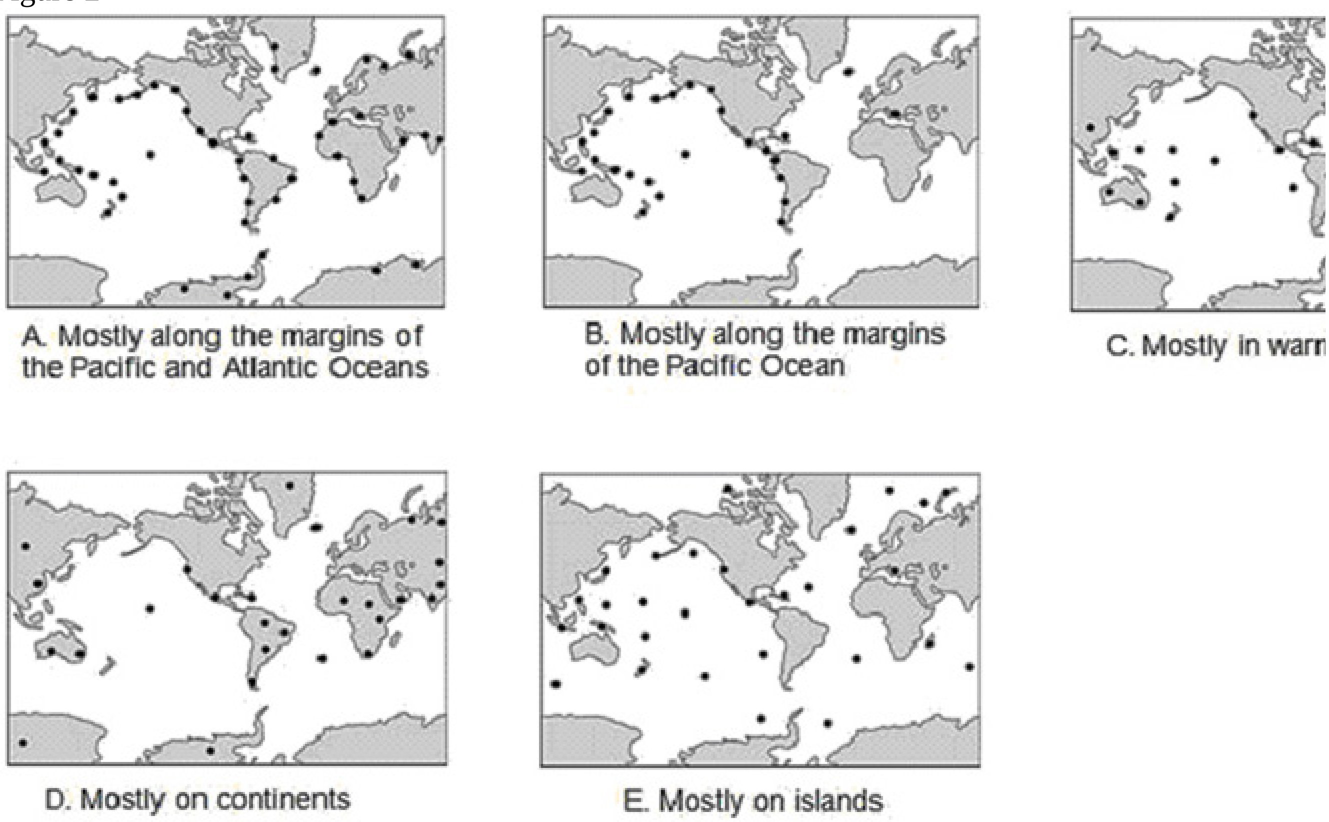
- 1

- 2
- 3
- 4
- 5
- I don’t know enough about this to make an educated guess

8. Which position on Figure 1 would be the most likely location for an eruption of a stratovolcano (also known as a composite volcano)?

- OHS
- DB
- CB
- CVA
- CHS
- I don’t know enough about this to make an educated guess

Figure 2



A. Mostly along the margins of the Pacific and Atlantic Oceans

B. Mostly along the margins of the Pacific Ocean

C. Mostly in warn

D. Mostly on continents

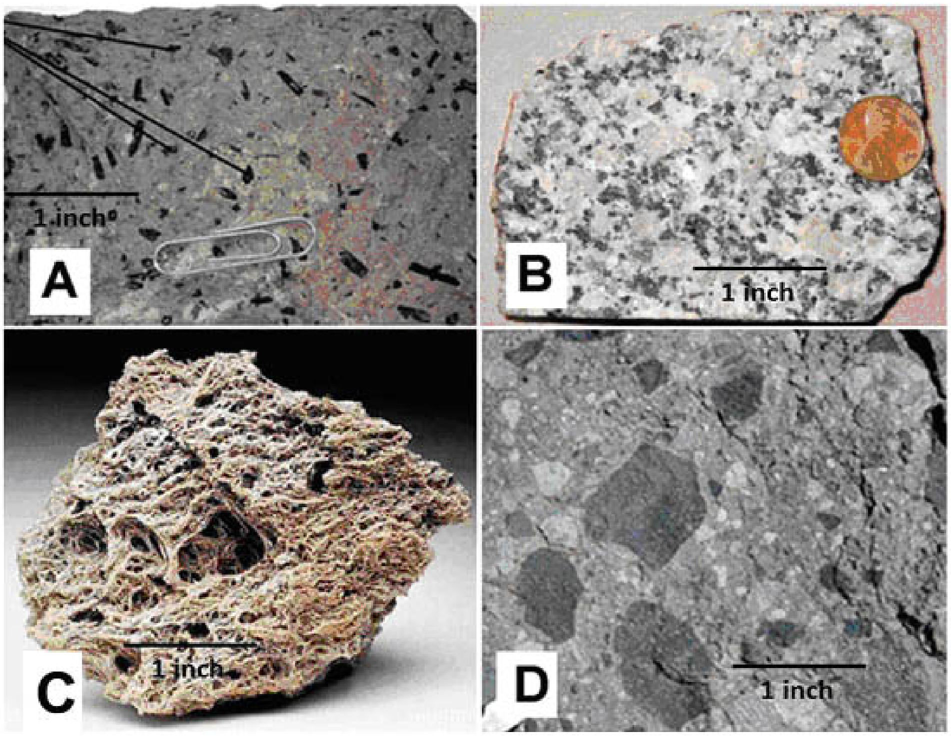
E. Mostly on islands

9. Figure 2 shows the position of the Earth’s continents and oceans. The dots on each map mark the locations where volcanoes occur. Which map most closely represents what is actually observed on the Earth?

- A

- B
- C
- D
- E
- I don’t know enough about this to make an educated guess

Figure 3



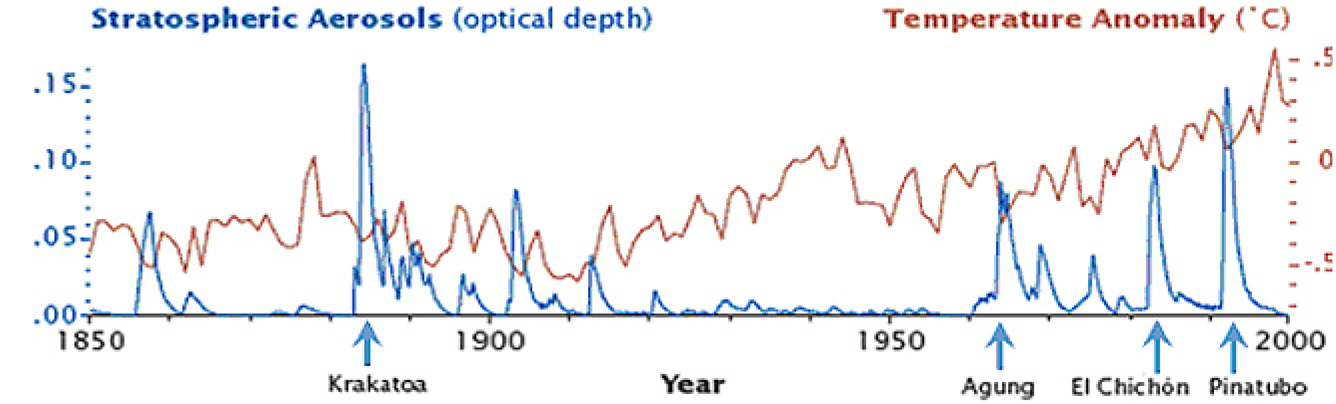
10. Which one of the four rocks above formed when magma cooled slowly and solidified below the Earth’s surface?

- A
- B
- C
- D
- I don’t know enough about this to make an educated guess

Stratospheric aerosols are minute particles (dust, ash, water droplets, etc.) that are suspended in the Earth’s second lowest atmospheric layer, the stratosphere. The concentration of stratospheric aerosols can be determined by measuring the transparency, or optical depth of the stratosphere. Optical depth is unit-less, and relates to the scattering or absorption of radiation along a path within the atmosphere. There is a direct relationship between optical depth and particulate

matter in the stratosphere.

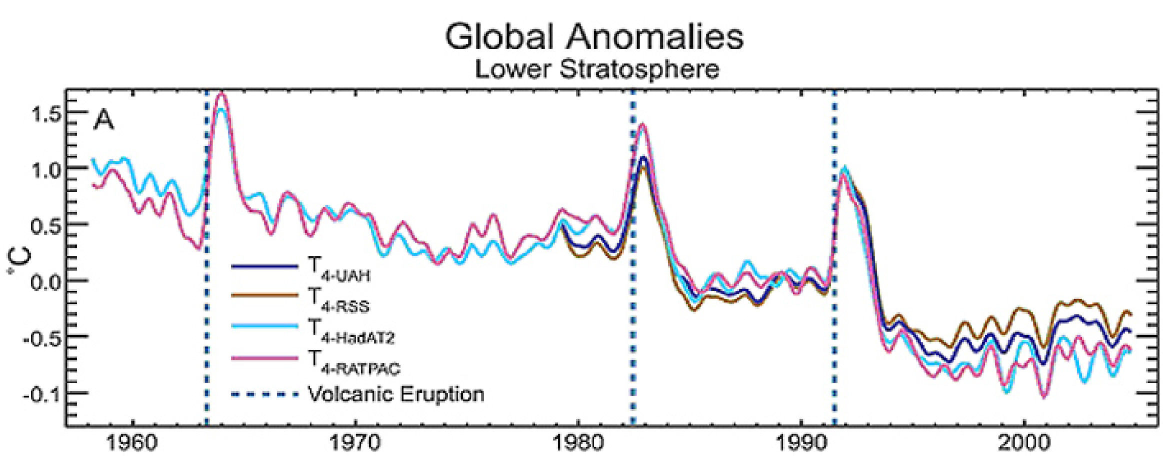
Figure 4

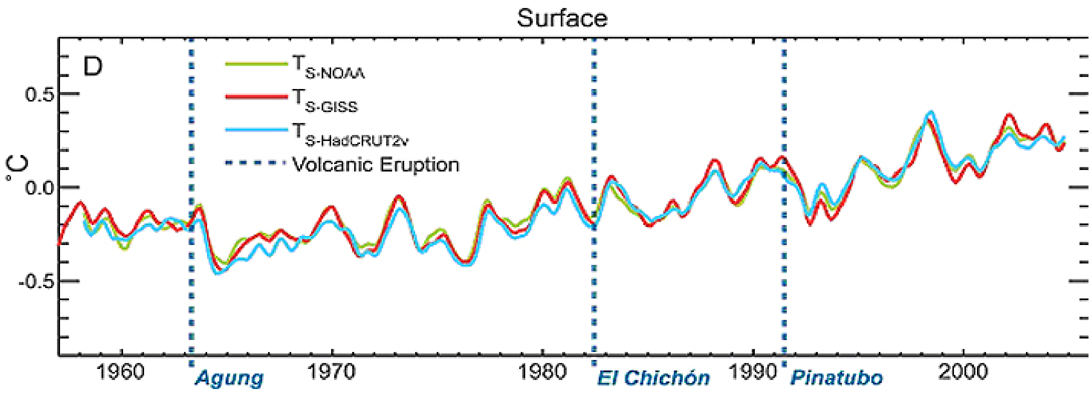


11. Examine the figure above. The largest amount of particulate matter was ejected into the Earth's stratosphere by the eruption of _______________.

- Pinatubo
- Agung
- Krakatoa
- El Chichón
- I don't know enough about this to make an educated guess

The two graphs below show changes in Earth's atmospheric temperature in the lower stratosphere and at the surface from 1957 to 2006. The colored lines represent different sources of data and variations in the methods of data collection. The last three major eruptions (Pinatubo, El Chichón, and Agung) shown on the graph from question 7 are illustrated with dashed lines on both graphs above, and are labeled on the bottom of the graph showing temperature changes at the Earth's surface.

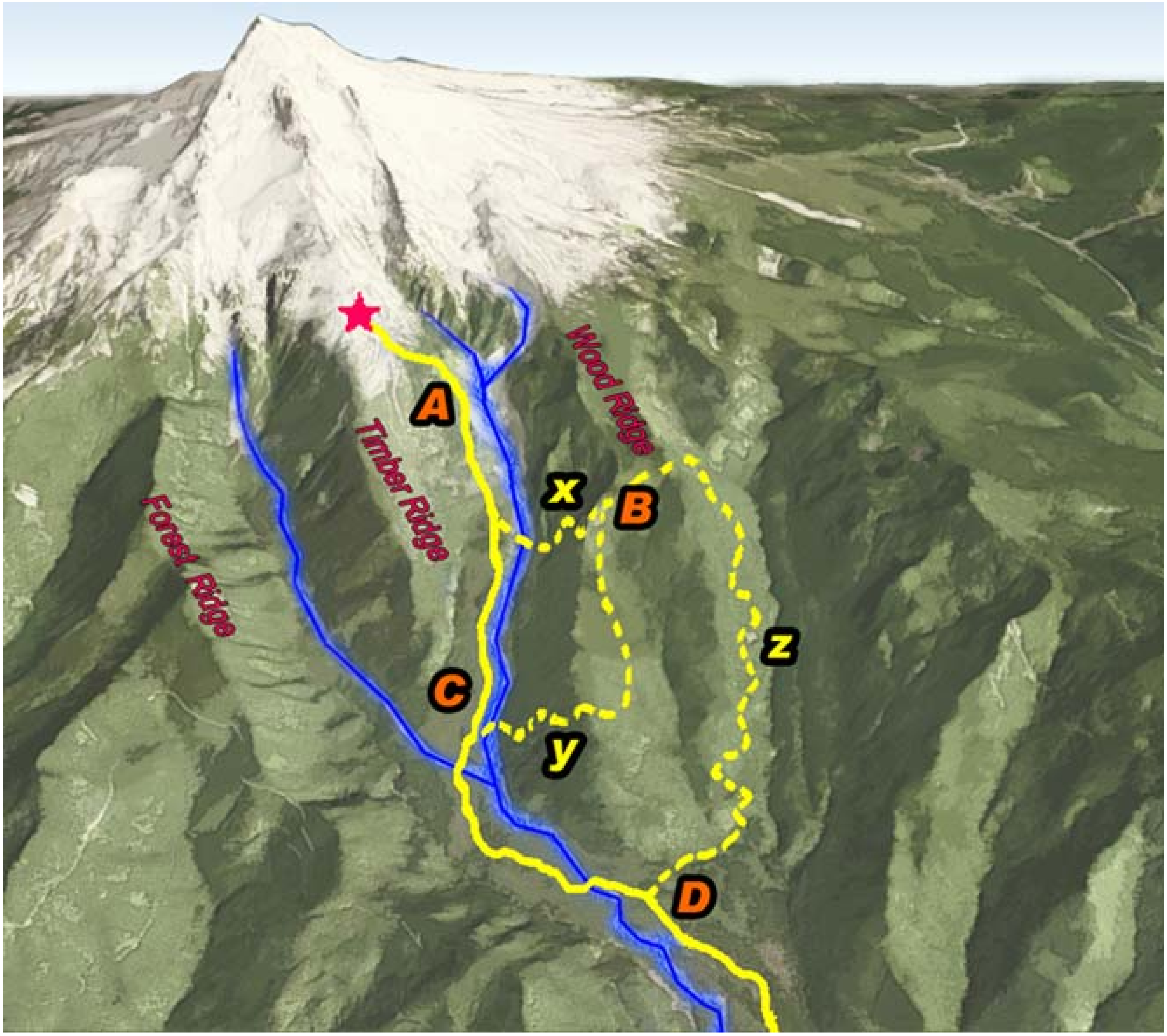




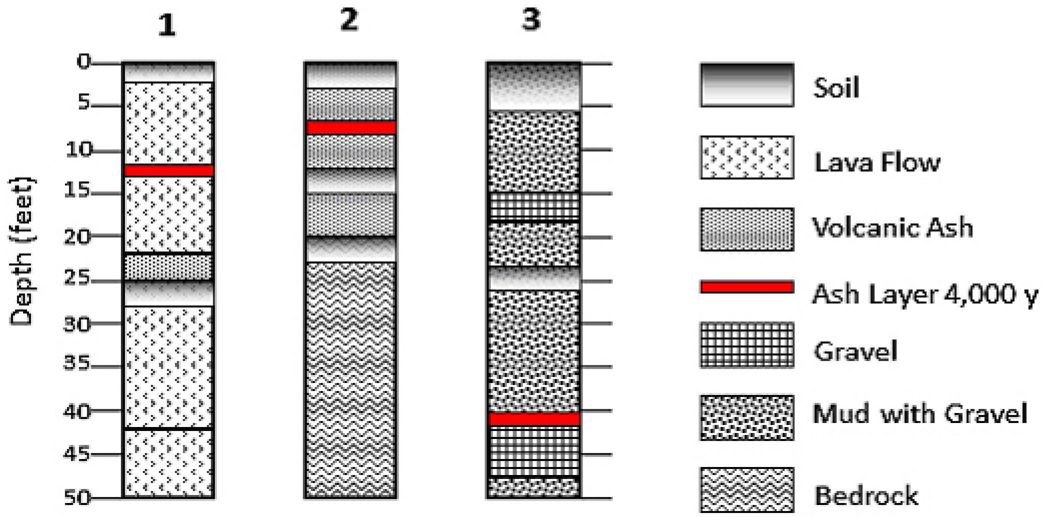
12. From the data shown on both graphs above, one can make the following generalization: major volcanic eruptions usually are associated with…

- ..short term (years) global cooling in the Earth's lower stratosphere
- ..long term (decades) global cooling on the Earth's surface
- ..sudden global warming of the Earth's lower stratosphere followed by short term (years) cooling to average temperatures
- ..both short term global cooling and global warming equally at the Earth's surface and in the lower stratosphere
- ..no effect on temperature at the Earth's surface or in the lower stratosphere
- ..I don't know enough about this to make an educated guess

The figure below shows a three dimensional view of a Cascades style volcano in a Pacific Northwest type of climate. The volcano is sketched using varying shades of green and white, rivers draining the volcano are shown as blue lines, an existing highway as a solid yellow line and possible routes for a proposed secondary road as dashed yellow lines. The star indicates the location of a ski area/boarding park. The lettered locations indicate the potential locations for an alpine village which would serve the ski area/boarding park with lodging, equipment rentals, restaurants and a hospital. You will be asked to evaluate the hazards posed by the volcano to the proposed village sites.



Wood Ridge
Timber Ridge
Forest Ridge
A
B
C
D
x
y
z



The columns above show the results of drilling at three of the four proposed village sites. Each column shows how the material recovered from the drill core changed with depth. A key to the symbols is given to the right. Ash Layer 4,000 y is an ash layer traced to an adjacent volcano that was erupted 4,000 years ago.

13. Which drill core was most likely collected at village site D?

- 1
- 2
- 3
- I don't know enough about this to make an educated guess

14. Which drill core was most likely collected at village site B?

- 1
- 2
- 3
- I don't know enough about this to make an educated guess

15. Which potential village site has the greatest lahar (mudflow) hazard?

- A
- B
- C
- D
- I don't know enough about this to make an educated guess

16. Which site has the least volcanic hazards?

- A

- B
- C
- D
- I don’t know enough about this to make an educated guess

17. The dashed lines show possible routes for a proposed road to site B. Rank these possible routes from best to worst in terms of evacuating site B in the case of a volcanic eruption.

- A.) x – y – z
- B.) x – z – y
- C.) y – x – z
- D.) y – z – x
- E.) z – x – y
- F.) z – y – x
- G.) I don’t know enough about this to make an educated guess

18. What volcanic hazard presents the greatest risk if village site B must be evacuated during a volcanic eruption?

- Lava flow
- Ash fall or flow
- Lahar (mudflow)
- Landslide
- I don’t know enough about this to make an educated guess

APPENDIX 6
Pre & Post-test Survey – Surface Processes
(G 202)

1. What is the 5 digit course number (CRN) for this class?

- 11481: RC / MW 9:00 - 11:50
- 14238: SE / TuTh 8:30 - 11:20
- 16100: SY / TuTh 2:00 - 4:50
- 17392: SY / MW 6:00 - 8:50

Q2

*
2. Please enter your first and last name in the spaces provided.

First [ ]

Last [ ]

Q3

3. After taking this course my interest in geology has increased.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

Q4

4. My understanding of geology contributes to my world view and how I make decisions as a citizen.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

Q5

5. Which geologic agent is the dominant landscape forming agent on the Earth today?

- glaciers
- ocean waves
- wind
- rivers

- landslides
- I don’t know enough about this to make an educated guess

Q6

6. Which best describes global sea level during the last ice age?

- About the same as today.
- Significantly higher (about 300 feet) than today.
- Significantly lower (300 feet) than today.
- Higher in the northern hemisphere and lower in the southern hemisphere.
- Lower in the northern hemisphere and higher in the southern hemisphere.
- I don’t know enough about this to make an educated guess.

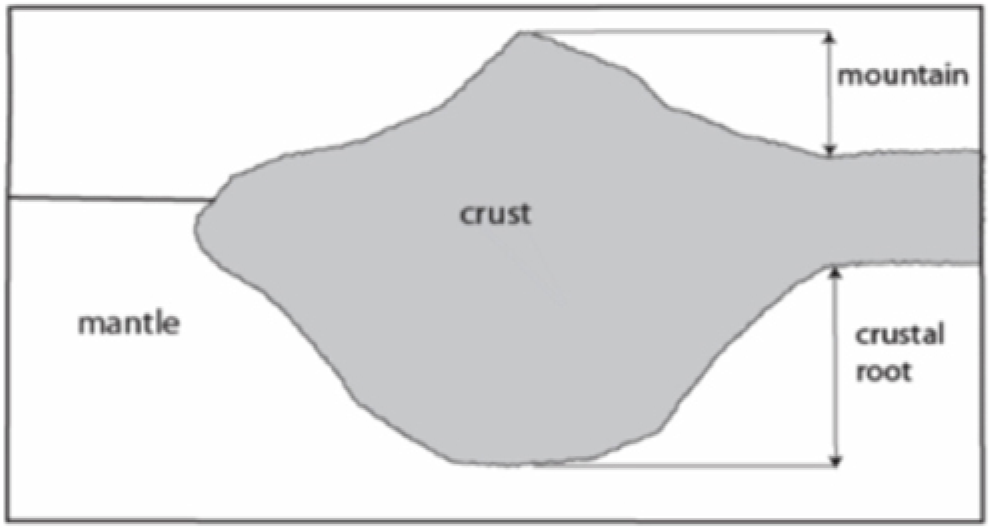
Figure 1

Q7

7. Which process formed the valley in Figure 1?

- It was carved by rivers.
- It was carved by glaciers.
- It was carved by wind.
- It was carved by landslides.
- I don’t know enough about this to make an educated guess.

Figure 2



Q8

8. Referring to Figure 2, how will the base of the crustal root respond to erosion of the overlying mountain?

- The base of the crustal root will move down.
- The base of the crustal root will not move.
- The base of the crustal root will move up.
- I don’t know enough about this to make an educated guess.

Q9

9. If you put a fist-sized rock in a room and left it alone for millions of years, what would happen to the rock?

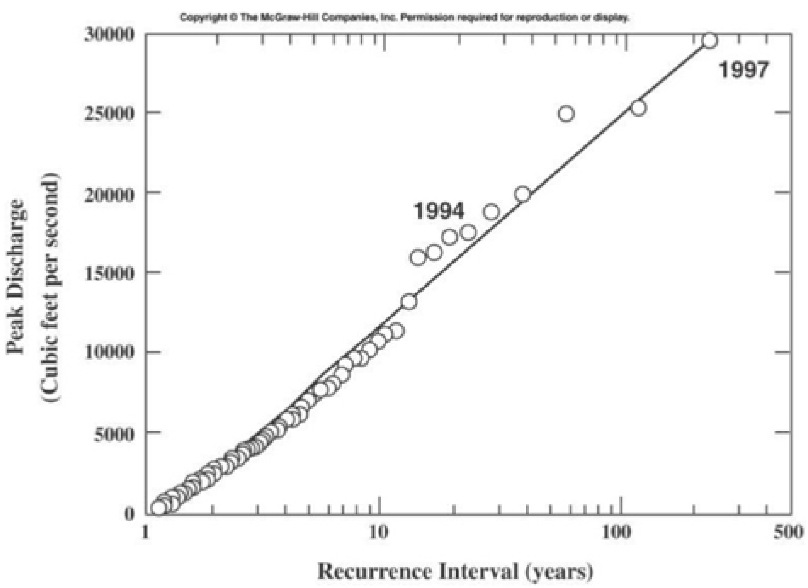
- The rock would almost completely turn into dirt.
- About half of the rock would turn into dirt.
- The top few inches of the rock would turn into dirt.
- The rock would be essentially unchanged.
- I don’t know enough about this to make an educated guess.

Q10

10. A toxic landfill site recently endured a 9.2 magnitude earthquake which caused the natural clay layer beneath it to fracture introducing a toxic slurry to the geologic strata beneath the landfill. Which type of underlying strata will result in the greatest contamination risk for local residents?

- Sand with high porosity and high permeability.
- Silt with high porosity and low permeability.
- Granite with low porosity and low permeability.
- I don't know enough about this to make an educated guess.

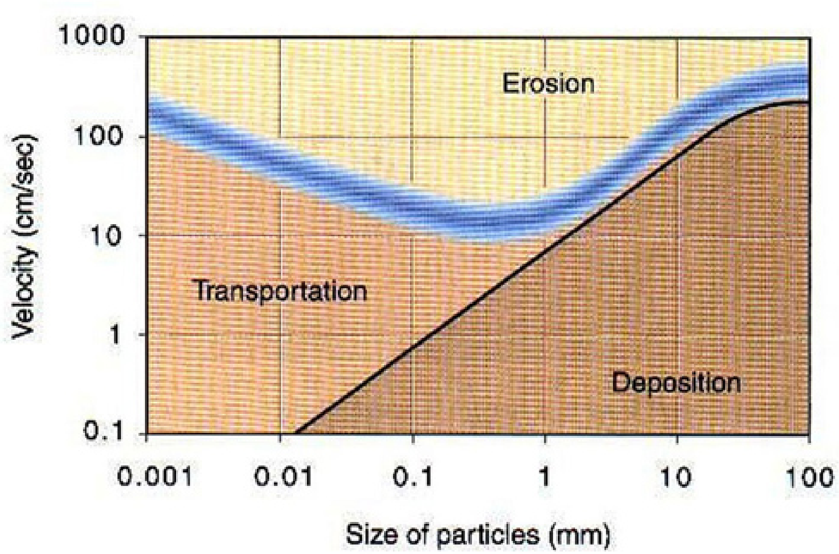
Figure 3



Q11
11. Figure 3 is a plot for a river near Fargo, North Dakota. Which stage is defined by a peak discharge of 25,000 cubic feet per second?

- Annual flood stage
- 5 year flood stage
- 10 year flood stage
- 100 year flood stage
- 500 year flood stage
- I don't know enough about this to make an educated guess

Figure 4

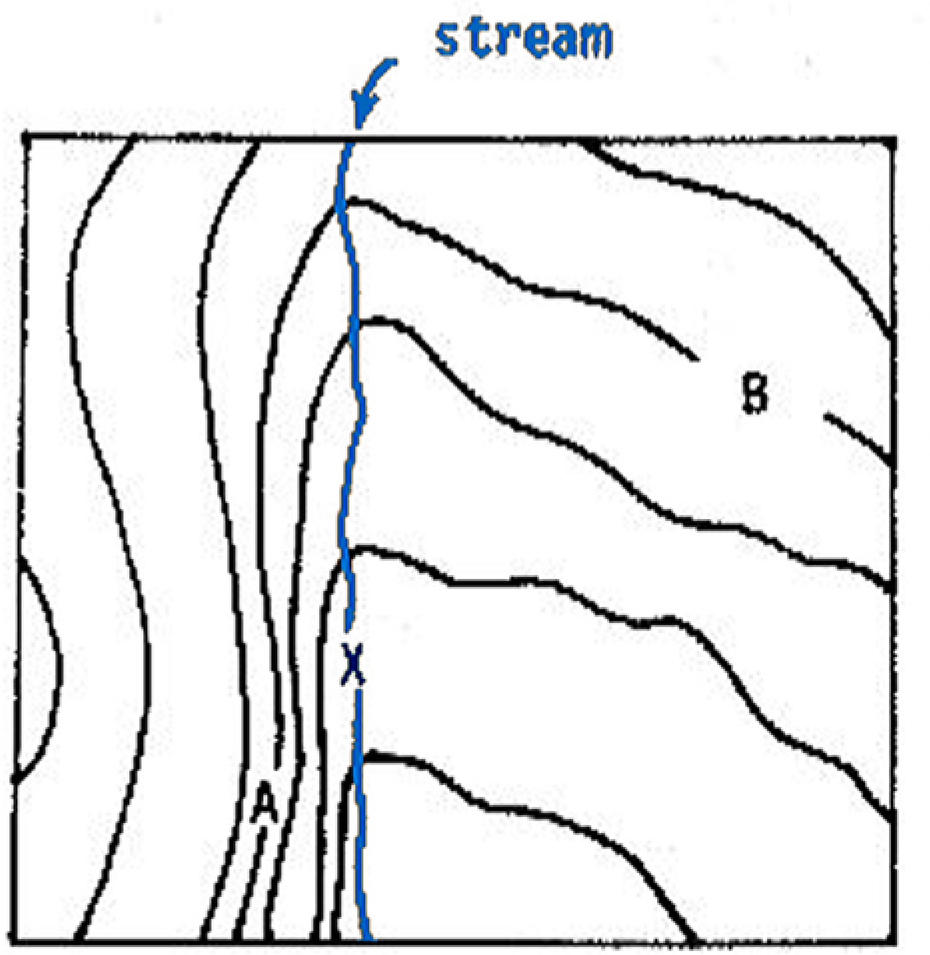


Q12

12. Above is Hjulstrom's diagram. Using this diagram *(Figure 4)*, at what stream velocity will a suspended particle 0.1 mm in size be deposited as the flow rate of a stream decreases?

- 0.1 cm/sec
- 1 cm/sec
- 10 cm/sec
- 100 cm/sec
- 1,000 cm/sec
- I don't know enough about this to make an educated guess

Figure 5



Q13

13. The diagram above shows contour lines as they cross stream X, which is drawn from North to South across the map area. If point B is at an elevation of 400 feet, and the map has a contour interval of 20 feet, what is the possible elevation of stream X as it leaves the map area?

- 410 feet
- 390 feet
- 370 feet
- 350 feet
- 330 feet
- I don’t know enough about this to make an educated guess

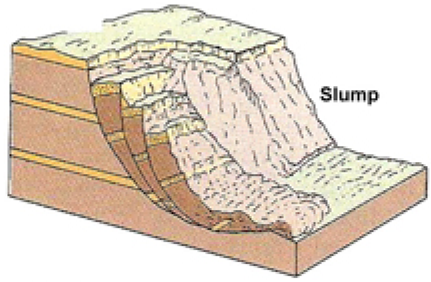


Figure A

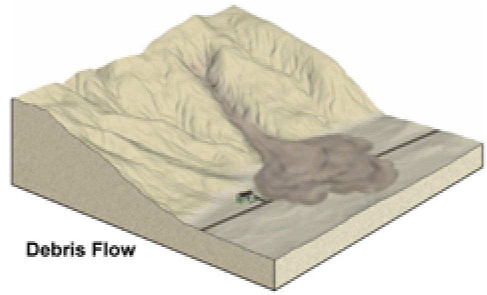


Figure B

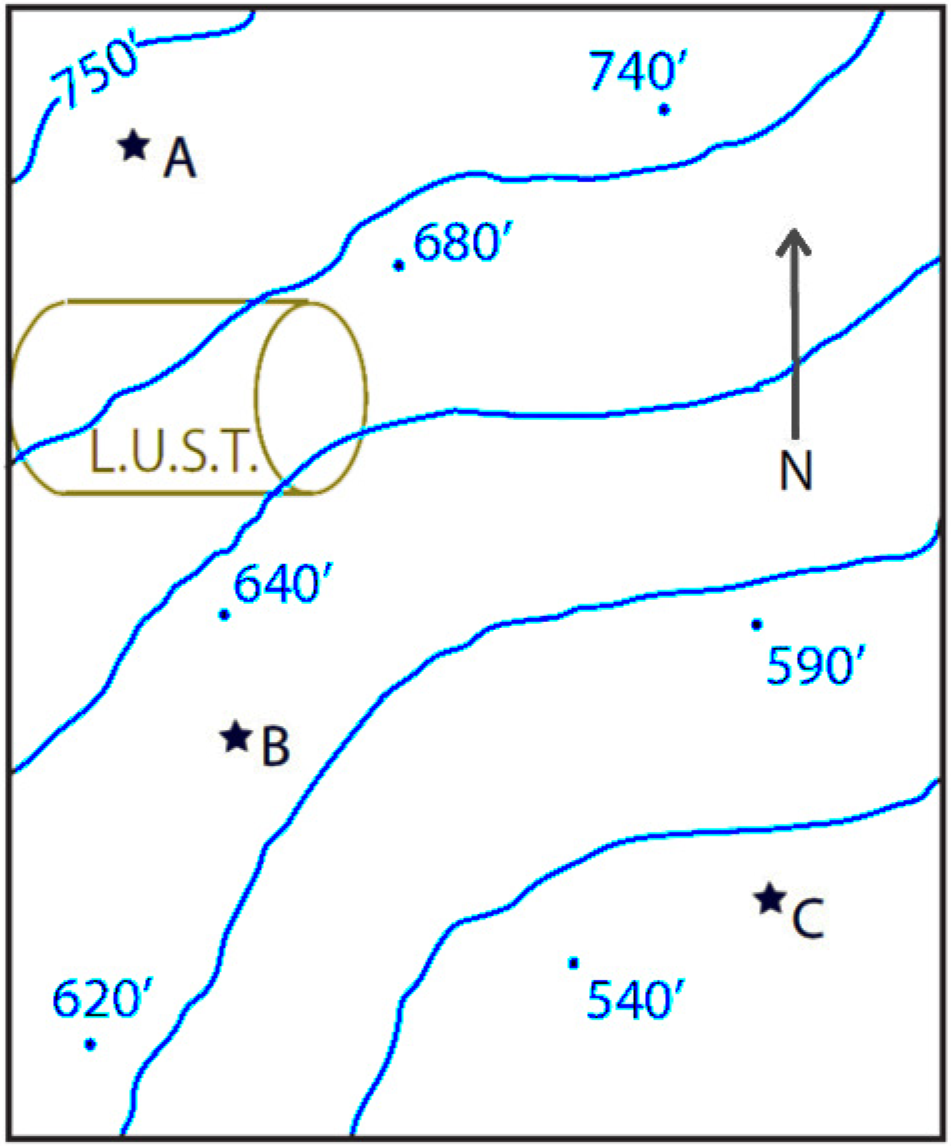
Q14

14. Based on field observations and aerial reconnaissance, two different 3-D illustrations were constructed for two different geographic locations as shown in Figure A and Figure B above. Which conditions most likely caused the mass wasting scenario in figure B?

- Continued seasonal variation in temperature causing freezing and thawing of the saturated loose sediment.
- Unstable geologic layers due to plate tectonic deformation.
- Frequent episodes of recent precipitation causing saturation of the loose sediment.
- Increased vegetative cover resulting in more root mass which breaks up the loose sediment below.
- I don’t know enough about this to make an educated guess.

The map below was drawn by a student analyzing the groundwater issues associated with the leaking underground storage tank (LUST). The numbers represent the static elevations of the groundwater table and the blue lines are contours of the groundwater table drawn by the student. A, B and C are groundwater wells. Use the data on the map *(Figure 7)* to complete the corresponding questions that follow.

Figure 7



Groundwater CI = 50'
L.U.S.T. = Leaking Underground Storage Tank
★A, ★B, & ★C = Well Locations

Q15

15. What is the exact elevation of the southern-most groundwater contour line drawn by the student on the map?

- 700 feet
- 650 feet
- 550 feet
- 500 feet
- I don't know enough about this to make an educated guess.

Q16

16. Which elevation makes the most sense for the water table in well A?

- 585 feet
- 615 feet
- 700 feet
- 735 feet
- I don't know enough about this to make an educated guess.

Q17

17. In general, which direction does groundwater flow in this map area?

- from Northeast to Southwest
- from Northwest to Southeast
- from Southwest to Northeast
- from uphill to downhill
- I don't know enough about this to make an educated guess.

Q18

18. Which well is least likely to be contaminated by the Leaking Underground Storage Tank?

- Well A
- Well B
- Well C
- I don't know enough about this to make an educated guess.

Q19

19. If well B pumps groundwater for a newly constructed water park, and Well A and C dry up, which concept below best explains why Well A and Well C dry up?

- Aquifer
- Artesian Well
- Confining Layer
- Cone of Depression
- I don’t know enough about this to make an educated guess.

APPENDIX 7
LAC Awards for Exemplary Assessment of Student Learning
(2014 & 2015)

LOWER DIVISION COLLEGIATE
2013-2014 ASSESSMENT REPORT

Exemplary Assessment

RECOGNITION IS GIVEN TO

GEOLOGY AND GENERAL SCIENCE

SEPTEMBER 15
2014

x

Wayne Hooke, Learning Assessment Council Chair

x

Chris Chairsell, Vice President of Academic and Student Affairs

Portland Community College

CERTIFICATE OF RECOGNITION

AWARDED TO

Geology & General Science

For Exemplary Assessment of Student Learning

Awarded this 14th day of September, 2015

Wayne Hooke, Chair
Chris Brooks, Vice-Chair
PCC Learning Assessment Council

&

Kendra Cawley, Dean
Office of Academic Affairs

APPENDIX 8
Geology Advising Session Flyer
(2015)

Interested in Geology?
Transferring to PSU?

GEOLOGY
ADVISING SESSION

Meet:

- Martin Streck & Mike Cummings: PSU Geology Chairs & Undergraduate advisors
- Eriks Puris: full time geology instructor at SE
- Former PCC students who have transferred to the PSU Geology department
- Members of CORIBA (PSU Geology Undergraduate Club)
- PCC students interested in forming a geology club at SE

Friday, Nov 20 from 12:00 – 1:00
The STEM Center SE Campus SCOM 231
2305 SE 82nd Ave

Enjoy free pizza!
RSVP appreciated!
Contact Sarah at
sarah.roseevans@pcc.edu
Or by phone 971-722-6146

APPENDIX 9
SAC Survey Results for 2016 Program Review
(November 2015)

1. How long have you been teaching at PCC?

#	Answer		Response	%
1	0-5 years		5	42%
2	6-10 years		4	33%
3	11-15 years		2	17%
4	16-20 years		0	0%
5	>20 years		1	8%
	Total		12	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	2.00
Variance	1.45
Standard Deviation	1.21
Total Responses	12

2. Are you a part-time instructor or a full-time instructor?

#	Answer		Response	%
1	Part-time instructor		10	83%
2	Full-time instructor		2	17%
	Total		12	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.17
Variance	0.15
Standard Deviation	0.39
Total Responses	12

3. Which best describes your teaching format at PCC?

#	Answer		Response	%
1	Face to face courses only.		9	75%
2	Distance learning only.		0	0%
3	Both face to face and distance learning.		3	25%
	Total		12	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.50
Variance	0.82
Standard Deviation	0.90
Total Responses	12

4. Which campus do you teach at most often?

#	Answer		Response	%
1	Cascade		1	8%
2	Rock Creek		4	33%
3	Southeast		3	25%
4	Sylvania		4	33%
	Total		12	100%

Statistic	Value
Min Value	1
Max Value	4
Mean	2.83
Variance	1.06
Standard Deviation	1.03
Total Responses	12

5. Do you teach at more than one campus?

#	Answer		Response	%
1	Yes		5	42%
2	No		7	58%
	Total		12	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.58
Variance	0.27
Standard Deviation	0.51
Total Responses	12

6. Lecture Room (AV Equipment, size, screens, table, chairs, white boards, computers, etc.)

#	Answer		Response	%
1	1		0	0%
2	2		0	0%
3	3		2	17%
4	4		7	58%
5	5		3	25%
	Total		12	100%

Statistic	Value
Min Value	3
Max Value	5
Mean	4.08
Variance	0.45
Standard Deviation	0.67
Total Responses	12

7. Comments:

Text Response
It seems as though with each remodel, the geology lab gets left behind. Our tables are great, chairs are ok. We only have two sinks, our eye wash station was installed incorrectly so it is a mess. Our cabinets are the original ones, and little room for maps on the walls due to more cabinets than needed. when all the other labs have had full remodels (chemistry especially). We also have the fewest computers compared to the other physical science labs. We could do with outlets on the lab tables, students often stretch cords for laptops across walkways. Our cork board is old and stained from spills by the garbage can. Lighting was just fixed during last remodel along with a new white board and shifting projector screen to gain more whiteboard access.
Computers are not very good, because sometimes they don't work well.
It works fine. It is difficult for students to see with computers up on the desks. Also, it would be nice to have more wipe board space so I didn't have to pull the screen up and down so often.
lighting is not ideal as we cannot dim down front table arrangement great for lab/group work and lecture, but less ideal for tests/exams, especially if 28 students in class;
I love our new building at Southeast.
I appreciate the white boards on side walls and the front wall of the classroom.
The lab room I teach at at SE is much worse than the lab room I used to teach at at RC. The board is at one end of a rectangular room along the short side of the rectangle, had the board been placed on the wall on the long side of the rectangle the site lines would have been greatly improved. The lectern blocks the white board, it should have been put to the side as it is in the lecture rooms in SCOM. The table are too high preventing students from seeing the bottom part of the white board. The chairs on casters are an earthquake hazard (rolling chairs during 5 minutes of shaking anyone?) The inability to bring total darkness to the room makes several astronomy labs and demos problematic. The white boards frequently do not erase very well. Lectern and cart computers are OK though they seem to be having some problems with Google Earth Pro this quarter.
We have everthing we need, but there are a few minor issues that could be improved upon. In one room, the lighting is not conducive for astronomy and meteorology demonstrations. In the other room, the screen should be replaced.
Occasionally, the podium needs a software update (e.g. "Adobe Flash plug-in" needed) and has not been done before my class starts (maybe 1-2x a year?).

Statistic	Value
Total Responses	9

8. Lab Room (Space, tables, chairs, electrical outlets, etc.)

#	Answer		Response	%
1	1		0	0%
2	2		0	0%
3	3		3	25%
4	4		8	67%
5	5		1	8%
	Total		12	100%

Statistic	Value
Min Value	3
Max Value	5
Mean	3.83
Variance	0.33
Standard Deviation	0.58
Total Responses	12

9. Comments:

Text Response
See above comments - lecture and lab room are the same.
There are only 6 computers in the Geology lab, which is limiting. Outlets are along the walls and often create major tripping hazards when students bring their own computers and need to plug them in. I often have a lab in a room that is not the Geology room, which makes it difficult to use certain supplies/equipment that are stored in the Geology room.
According to the students, the chairs are uncomfortable. I wish there were some outlets in the tables. I wish the screen didn't cover the white boards.
It is nice to be able to get into the room before and after the lab to set up and put away materials. Sometimes this doesn't happen and the samples are quickly put away (not very organized) in order for the next class to come in. It is also nice to be able to have office hours in the lab room so that students can look at examples of rocks and minerals while they are asking questions-this isn't always possible with the tight classroom schedule at Cascade.
I lecture and teach lab in the same. Shockingly the room is short a few electrical sockets.
Once again we have everything we need to do an adequate job during laboratory investigations. It would be much more efficient if we could install cabinets into both rooms which could permanantly hold standard laboratory materials. This would allow instructors the opportunity to put students in charge of aquiring, utilizing, and returning laboratory materials for themselves. I feel this supports PCC core outcomes such as professional development, problem solving, and communication. In addition, this would save a significant amount of instructor time spent moving materials in and out of the room on carts. It would also avoid the issue of having materials in the wrong location because instructors were out of time at the end of the work day and didn't have time to return them to the appropriate storage area.
Students really love the new lab space and layout.

Statistic	Value
Total Responses	7

10. Lab Equipment (Quality, quantity, age, etc.)

#	Answer		Response	%
1	1		0	0%
2	2		0	0%
3	3		3	25%
4	4		7	58%
5	5		2	17%
	Total		12	100%

Statistic	Value
Min Value	3
Max Value	5
Mean	3.92
Variance	0.45
Standard Deviation	0.67
Total Responses	12

11. Comments:

Text Response
For the most part things are good, although it has been a struggle to get supplies ordered as a part timer.
The Podium computer is not very good.
Everything works and is very organized now! It would be nice to have an easier time getting new supplies.
it is getting better every year
There's always something we want. But overall, I am happy with what we have.
It would be nice to have more samples for lab. It would be nice to have more diversity in models/demos/visual aids to use during teaching. It is useful to me to see what sorts of things other campuses are using so that I can get ideas for things that Cascade could order i the future.
Still building up the collection at SE.
There are a few materials that don't hold up real well. We have struggled to find decent sling psychrometers, skymasters, and gps units that are consistantly reliable. It would be dreamy to have a planetarium, observatory, and seismograph on campus.
Students do enjoy the new lab demos/gagets.

Statistic	Value
Total Responses	9

12. Lab Tech Support

#	Answer		Response	%
1	1		0	0%
2	2		1	8%
3	3		3	25%
4	4		5	42%
5	5		3	25%
	Total		12	100%

Statistic	Value
Min Value	2
Max Value	5
Mean	3.83
Variance	0.88
Standard Deviation	0.94
Total Responses	12

13. Comments:

Text Response
We don't usually ask for support, but when we do it is great! Our lab techs are more chemistry focused, with little geology experience.
Jacob is fantastic, but doesn't usually assist with setting up my labs.
Steve and Avery are the best. I have always been able to get what I need from them.
Better than last year. Lab techs seem to be afraid of earth science, would be nice to get some lab techs with earth science backgrounds. Would be nice if lab tech showed more initiative in organizing and cataloging teaching equipment.
Jacob is amazing!
It's been sparse for G/GS at Rock Creek. Last year we were able to secure a work study student who was fantastic, this year we could not find one available at the right time of the day. We are hoping to get a casual worker through division funds until we can find another work study student. It seems like there are a lot of hoops to jump through regarding this issue.
Support is good, although some communication issues exist.

Statistic	Value
Total Responses	7

14. Technology (Lab, Computers, etc.)

#	Answer		Response	%
1	1		1	8%
2	2		1	8%
3	3		4	33%
4	4		4	33%
5	5		2	17%
	Total		12	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	3.42
Variance	1.36
Standard Deviation	1.16
Total Responses	12

15. Comments:

Text Response
See above - could use more computers. Only 6 for a lab of 24 students.
Mentioned above
We need more computers in the lab. It would also be nice to have more computer flexibility, i.e. not have to have the computer image for the entire year planned in the summer.
Glad we have the computers, wish they were always plugged in so that when we need them they were charged.
I use a mobile class set of laptops occasionally for geotours or looking at other data sets online in class. This has been working out pretty well.
The Vernier equipment is a bit of a let down, frequently doesn't work on the first try. I don't really trust the measurements, reproducibility seems poor. Computers or OK, having problems with Google Earth Pro as previously noted. Log in to wi-fi was simplified this year, however in a batch of a dozen computers one or two seem to misbehave every class period.
We have 6, more would be better...and faster would be ideal. It would also be really nice if someone could permanently point kmz/kml files to Google Earth. We literally have to do this on every computer, every single time we use overlays on GE. :-/
One of our two rooms has 15 computers, and the other has 8. This is a problem that we need to fix. An instructor in one lab can have pairs work together while an instructor in the other room has to split the class into two seperate groups and find at least two different activities that can be run simultanously. It would be nice if all students and instructors had the same resources. Maybe it's time for a mobile cart with laptops or tablets possibly.

Statistic	Value
Total Responses	8

16. Textbooks and Lab Manuals

#	Answer		Response	%
1	1		1	9%
2	2		1	9%
3	3		2	18%
4	4		4	36%
5	5		3	27%
	Total		11	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	3.64
Variance	1.65
Standard Deviation	1.29
Total Responses	11

17. Comments:

Text Response
Textbooks are all great resources. I do not use any lab manuals. The new edition of the Ahrens textbook is nearly $200, though, which is way too expensive in my opinion. Not sure if there is a better option.
happy with textbook selection; we are not using lab manuals but have to put together our own labs; I am fine with this now after so many years of teaching, but I think it is a challenge for new people
Thank you for ordering the books for me Eriks.
I did have trouble using geotours at one point this fall because the norton website was down. I contacted the authors of the activity and got the resources I needed.
Textbooks are OK. I create my own lab manuals, these would be better if I had more time to work on them- currently they are OK.
I need a 0 here. The textbook is way too expensive. Most of the relevant information is readily available from the internet, old textbooks, lecture slides, etc. I don't use the lab manual. If you need someone to work on standardizing lab manuals (with pay) I am your girl.
The textbook does not drive my curriculum, but is a great resource. I am happy with the quality of the textbooks we have currently adopted as a SAC. The only issue I have is the overall cost to the students. Many of them have figured out how to rent, beg, borrow, and steal as necessary.

Statistic	Value
Total Responses	7

18. Current mix of G/GS courses.

#	Answer		Response	%
1	1		1	9%
2	2		0	0%
3	3		2	18%
4	4		5	45%
5	5		3	27%
	Total		11	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	3.82
Variance	1.36
Standard Deviation	1.17
Total Responses	11

19. Comments:

Text Response
It seems like there is a good mix of courses at Sylvania campus. Not sure if the order/arrangement of courses could be optimized, but from my perspective things seem fine.
class schedules between campuses could be more coordinated so that no overlap
Would love to see a hydrology/water quality course.
I am really enjoying the G-201/G-202/G-203 courses and we have now gotten all of them to run at least once at Cascade in the past year. The GS courses are also fun to teach and I wouldn't mind teaching more diversity in courses (G-208 and G-209 at Cascade for example).
At PCC, the next terms classes are scheduled so late, that I am usually booked up with other classes at my other 2 jobs. Even though I prefer working at PCC. :-/
I enjoy the variety of courses that we offer as a SAC and feel it is appropriate to help meet the many needs of our students. I personally would like to substitute one of the new G courses for one of my GS courses in the near future. It is exciting to be offering more options for our students.
Good balance of the Geology and other Earth Science classes. I hope tha the new addition of G-148 and G-184 classes will stimulate new interest in the G/GS offerings, which is among the most popular of our science classes.

Statistic	Value
Total Responses	7

20. Suggestions for SAC Chairs.

Text Response
I think it would be great to have all G/GS instructors share their course materials on a shared drive. This would give us all ideas for improving our courses and also be helpful to new instructors.
I relaly enjoyed going to NAGT with the small group of PCC geologists that went last time. It would be great to continue doing this every year or maybe every other year.
Lighten up!
Is this a paid position?
add a 1 or 2 credit field course that does not require much classroom time in advance (maybe one evening for background and logistics) - the learning is mostly on the trip. Use this to get people excited about Geology and draw them into the field. What about an online course with a lab component? The new climate change class seems like it might work well in this format and could fill a real need for students who are trying to do most of their coursework online.
Think about the SAC as a whole and also consider each instructors personal needs as well.
We need better coordination of what G/GS classes are being offered district-wide. Now that SEC is the new campus, and with its surging enrollments, some of the other campuses are feeling some drain. The coordination needs to be done when the following term schedule in being "penciled out." Given what happened in Fall 2015 (two evening sections of GS-109 MET, not know to either instructor), there needs to be better, strategic planning amongst the campuses. This was an issues that was talked about in our G/GS SAC a year ago, but apparently no plan/protocol was offered, let alone established.

Statistic	Value
Total Responses	7

21. Suggestions for Department Chairs.

Text Response
Give more attention to the geology lab in the next remodel!
The sooner I can find out my schedule, the better (even if it is tentative/based on enrollment numbers)! It was great to have it so early this year.
There should be more communication about scheduling courses among department chairs at different campuses. It helps enrollment when courses are offered at different times (and even different terms) at different campuses. I understand that sometimes if a course gets cancelled due to low enrollement it is given a second chance the following term - this is great. But I think when that happens there should be communication between the campuses so that it doesn't overlap with what the other campuses have going on.
Spend more time coordinating G&GS course offerings across the college.
Allow more flexibility in scheduling.
Show more flexiblility when a class enrollment is at the edge (12 vs. the min. 15).

Statistic	Value
Total Responses	6

22. Suggestions for Division Deans.

Text Response
Alyson and Besty have been great to work with.
Put more effort in promoting research opportunities and internship opportunities for our students as this will lead to success stories that will help with recruitment and make expanding access worthwhile. (Is it really all that wonderful to improve access to general ed credits?)
None at Rock Creek, excellent work!
None...but do keep up the good work in supporting the G/GS SAC.

Statistic	Value
Total Responses	4

23. Should we develop a third new course on the Geology of the National Parks?

#	Answer		Response	%
1	Yes		11	92%
2	No		1	8%
	Total		12	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.08
Variance	0.08
Standard Deviation	0.29
Total Responses	12

24. Comments:

Text Response
As a former National Park Ranger, I would LOVE to develop one! :) I have contacts at many parks.
That sounds like a great course!
This course could teach the unique qualities of these parks. This will increase park appreciation and perhaps when budget cuts are considered, make for educated voters.
Sure, I don't see why not. It would be nice to include parks that students are most likely to have visited so that the course will be more relevant to their experiences. Would it transfer to PSU? I suspect it would probably not be a lab course?
The troika of G 148, G 184 and national parks would make for a nice year long block of teaching.
Many students have demonstrated a real interest in a National Parks class when I mentioned the idea of it.
I have seen this class offered at the bigger schools. At EWU, this 300-level class was almost as popular as the GEO-100 classes and always filled.

Statistic	Value
Total Responses	7

25. What is your general preference regarding teacher autonomy

in meeting the expected outcomes outlined in the course curriculum outcome guidelines "CCOG's"?

#	Answer		Response	%
1	I would like a highly detailed & specific list of expected lessons, labs, and lectures for the course I teach.		1	8%
2	I would like a list of suggested lessons, labs, lectures for the course I teach.		2	17%
3	I would like freedom regarding lecture materials but would like an expected list of labs.		0	0%
4	I would like a pool of lab experiments to draw from, but no expectations of using them.		6	50%
5	I would like total freedom regarding lectures and labs that I use in my classroom.		3	25%
6	Other.		0	0%
	Total		12	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	3.67
Variance	1.70
Standard Deviation	1.30
Total Responses	12

26. Comments:

Text Response
It would be nice for a new instructor to have an idea of what is expected to cover in our courses - and to have some resources to pull from. As a longer term employee, I would like to see what others are teaching to not only get new ideas, but so make sure I am covering the material in the best way that benefits the students learning.
I really like having the freedom to teach as it works best for me. In a 10 week course, we always have to cut down the topics and it is nice to have the choice about which topics to include. On the other hand, with a field that is so diverse and instructors having expertise in only 1-2 areas maximum, I can see how more structure could be important to providing a more consistant and rigorous educational experience for the students. At the very least, having a repository of labs to draw from would be extremely beneficial.
I think Eriks idea of listing lectures and labs in communal folders is an excellent idea. When I taught meteorology for the first time, I had to create all the lectures and labs because there wasn't anything to draw from. I think that shared curriculum, especially as a part timer, is a must. There just isn't enough pay to warrant curriculum design, lab setting up and breaking down and grading as well as teaching time and office hours. So since quality education is the objective, pre-made labs and powerpoint would be helpful
It is very desirable to support instructors with curriculum (especially labs) which they can chose to use as they see fit. Some commonality between the different sections of a course is desirable. It would be great to have some common test questions which involve the application of concepts to novel situations and the critical evaluation of course material. Being able to compare the responses of students with different classroom experiences to the same test questions could be really instructive. Of course how each instructor teaches the course material would be left up to the individual instructors.
But I am totally open to adopting a set of labs we all agree to use. -OR- I am all for having a pool of labs and activities we can draw from!! I really appreciate what Eriks and Frank have done to this end. :)
I worked in a system where administration tried to micro-manage teachers to facilitate higher standardized test scores. This strategy literally sucked the passion out of the faculty. I am a firm believer in teacher autonomy. Students will learn best when the instructor is passionate about what they are teaching and have the freedom to teach it in the way they see most fit. If the CCOG's are being met, I feel each instructor should be able to utilize the method that works best for them to accomplish this goal. I understand the idea of a list of possible labs for new instructors to use, but firmly believe that they should be able to decide which labs would be most efficiently implemented in their own classroom.
It is wrong for an instructor to be dictated to as to what lecture/labs to use. Each one of us brings special strengths and perspective to our teaching methods. We should be given the professional latitude as to what is best for our classroom.

27. This year PCC is discussing the possibility of creating majors for its lower division collegiate students. In your opinion would a major be useful to G/S students. What would a G/GS major which benefits our students look like?

Text Response
It could be useful for folks going into science - however I maybe see one or two students that plan to be science majors, let alone geology majors. I think this is a question that students would have a better answer for.
If this is GS, the answer is NO, but for Geology is YES.
The only way that I see a major being more useful than the current system is if students get improved advising based on their choice of a major. I don't know much about this topic, though.
I would love to see more students majoring in geology, but with the student body we have at the college, probably not.
General science should be just that, general science. However, creating and Earth Science major makes a lot of sense. It allows the department to identify majors and help them with specific counseling. I heard from several students that their counselors had no idea which school had a Geology major, nor did they know where they could find scholarships. It is such a specialized major and there are specific schools
It could be useful for students who know they are planning on majoring in something related to earth and environmental science. It might involve taking all of their math, chemistry, physics, and biology courses that are going to be required for an earth science major at a 4YC and additional courses that are normally taken as a first year student at a 4YC. For example physical geology and historical geology could be taken at a 2YC and then after transfering students would be ready to jump into upper level courses and be at the same level as students who went directly to a 4YC out of high school.
A major would be of limited use to our students. More useful would be a strong math and science background plus some sort on internship or research experience all supported by strong writing skills. A physical science major which stresses math through calculus plus university level chemistry and physics coupled with some sort of internship or research experience would be the most helpful to our top students. Of course many of our students are no where ready for such a rigorous foundation in physical science. These students would be most helped by getting as much math under their belts as possible plus some courses to keep them interested in earth science. The vast majority of students would be most helped by just having a chance to discover if they are interested/like earth science.
Yes! You'll have to pay me for that!!
G 201,202,203 COMM 111 WR 227 as many as possible from: Physics 211,212,213 Chem 221,222,223 Math 251, 252, 253
I feel that it might benefit a select few of our students. I do believe that if the other institutions are moving towards this, then we will need to follow suit. It might be advantageous to have a generic general science major for those considering Geology, Astronomy, Ocenography, Meteorology, etc. I don't think we should try to differentiate majors for each of our subject areas.
YES! It would have been nice to have this option when I was in community college back in the day. A G/GS major should contain at least one Geology and one GS course apiece, plus one elective from either category.

Statistic	Value
Total Responses	11

28. In your opinion how do G/GS courses contribute to the general education of PCC students?

#	Answer		Response	%
1	Inferior		0	0%
2	Below Average		0	0%
3	Average		4	33%
4	Above Average		6	50%
5	Superior		2	17%
	Total		12	100%

Statistic	Value
Min Value	3
Max Value	5
Mean	3.83
Variance	0.52
Standard Deviation	0.72
Total Responses	12

29. What is your opinion regarding G/GS and our role in General Education at PCC, in Oregon, in the United States?

Text Response
I think it is important for students to know how the world around them formed. G/GS courses get students to think outside their own bubble for a term or two - which is important!
Geology and the General courses are very useful for general education.
I think that exposing students to Earth science is an extremely important pat of general education. Many students that I teach are unfamiliar with maps and with the world around them. In addition to learning concrete math/science skills, I hope that students will develop an awareness and appreciation of the natural world around them. I would consider that equally important to the more academic skills we teach.
probably not much application in their jobs, but in daily lifes: awareness of environmental issues, earthquake preparedness, landslides, water, etc
I believe that teaching general education students about the earth, oceans, atmosphere and the universe is mandatory. It creates educated voters. We have an opportunity to teach students the art of reaching beyond their personal fears and be successful learners. But more than this, it allows students to overcome their fear of science and perhaps even transcend that fear to a deep appreciation for the wonders of nature. What could be better than being able to survive the earthquake because you are educated, know what is going on and have prepared a plan and an earthquake kit. Or to look up at the sky and see the movement of the clouds and know what weather to expect. On a large scale, it is becoming familiar with the world around you.
Earth science is an important part of general education in the Pacific Northwest because we live in a very geologically active area. It would be beneficial to our society if we had a well educated population who knew about geologic hazards in our area.
Earth science courses can play a very important roll in creating a science literate electorate. More important is getting citizens to understand strengths and limitations of the scientific method and evidence based practices.
Well the Earth System is in chaos, so it stands to reason that having knowledge of how the Earth actually works is critical information for every human to learn.
excellent way to integrate science and current events relevant to many students who aren't naturally attracted to sciences
In Oregon, we are surrounded by a mulitude of amazing natural areas that pertain to the subjects we teach. While helping our students work towards a degree, we can offer the opportunity to earn lab science credits and learn about thier surroundings at the same time. Becoming educated about thier surroundings enhances our society by instilling an appreciation for our natural areas and preparing students for the hazards that accompany them. G/GS plays an important role in general education at PCC.
The G/GS program is very popular with our students - partly due to the subject matter, and partly due to the amazing talented instructors that teach this course with a real passion of the subject.

Statistic	Value
Total Responses	11

30. Comments:

Text Response
Comment re: G/GS contribution to general education of PCC students... I think G&GS courses allow many students to meet their general education science course requirement with courses they find interesting.
Umm, I like Idaho potatoes.

Statistic	Value
Total Responses	2

31. What is your opinion regarding PCC's core outcomes (Communication, Community & Environmental Responsibility, Critical Thinking & Problem Solving, Professional Competence, Cultural Awareness, & Self Reflection)?

#	Answer		Response	%
1	Start over		0	0%
2	Sub-par		1	8%
3	Average		4	33%
4	Above average		6	50%
5	Superior		1	8%
	Total		12	100%

Statistic	Value
Min Value	2
Max Value	5
Mean	3.58
Variance	0.63
Standard Deviation	0.79
Total Responses	12

32. Comments:

Text Response
The professional competence CCOG is a tricky one - for the most part our students are non-science people and struggle just to get through the course. I think it is a stretch to ask these students to stretch to that level of knowledge.
These are great core outcomes. I am not sure how they translate to the day-to-day running of the college.
Would like more information regarding where we can find the specific criteria for each class if there are guidelines beyond the course description.
Missing outcomes in quantitative literacy and ethical decision making. General statements of outcome are OK. The more detailed amplification of the outcomes on the PCC web page are all over the place and need to be reworked.
G 161 needs work. If you pay me, I'll do it. :)
These seem like appropriate outcomes for students attending our courses at PCC. Other than the annual assessment plan, I'm not sure I think much about them. I believe many of the core outcomes are incorporated into our lessons without even thinking about it.
The "Cultural Awareness" part is Politcally Correct bullshit, as is "Self Reflection." Sounds like something for a mush-head hippy commune outing. Maybe replace with "Societal Relevance"?

Statistic	Value
Total Responses	7

33. How involved have you been with the SAC's assessment of college core outcomes?

#	Answer		Response	%
1	I participate every year		4	36%
2	I participate some years		6	55%
3	I have never participated		1	9%
	Total		11	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.73
Variance	0.42
Standard Deviation	0.65
Total Responses	11

34. The SAC's assessment of the college core outcomes is real, authentic and useful.

#	Answer		Response	%
1	Strongly Agree		1	8%
2	Agree		6	50%
3	Neither Agree nor Disagree		4	33%
4	Disagree		1	8%
5	Strongly Disagree		0	0%
	Total		12	100%

Statistic	Value
Min Value	1
Max Value	4
Mean	2.42
Variance	0.63
Standard Deviation	0.79
Total Responses	12

35. Comments

Text Response
I am not very familiar with the SAC assessment.
The stronger we can make our courses the easier they will be to transfer to 4-year schools.
Is this question referring to the pre- and post-assessments that we have had students in certain courses take during the term? I think it would be most useful if the assessments were open well before the first day of class (~a week) so that it can really be a pre-assessment. One term this was late getting set up and I felt that we had already talked about things in class that were showing up on the assessment - so in that case I'm not sure how authentic the outcome was for the pre-assessment.
Assessing college core outcomes at the course level is dunderheaded. It would be far more beneficial to align the course level outcomes with the college outcomes and then assess course level outcomes at the course level. The assessment of college core outcomes would feel more real if it were not an unfunded mandate. The unwillingness of the administration to fund the assessment of college outcomes undercuts the credibility of the administration's efforts. If they really mean it they should put their money where their mouth is and support the faculty's work in assessing college outcomes by reducing teaching loads and/or increasing pay and then funding curriculum improvement projects designed to meet needs identified through the assessment process. Personally the extra effort I have spent over the last few years in assessing outcomes has been funded by spending less time grading student work and spending less time improving my courses.
I think pre and post tests, can be useful educational tools. My students seem genuinely interested in how much they have grown over the course of a term. Our assessment does not cover all of the information that we cover in our courses, but does touch on PCC's core outcomes while covering some of the curiculum. Our assessment currently does not provide students or instructors specific feedback on thier personal growth unless the instructor chooses to incorporate a method of sharing the results. We would like a more efficient assessement tool to allow instructor access to this information if possible. I have my students document thier responses on paper for both the pre and post tests. We spend five minutes on the last day of class grading both so they can see their progress. It also serves as a mini review session since there are some concepts that will end up on the final test. I feel that our assessment method has potential.

Statistic	Value
Total Responses	5

36. What professional development activities have you been involved in since the last program review (2010).

Text Response
Quality Matters Peer Reviewer (for online courses) and I went to GSA last year in Vancouver.
Inservices, attended AGU, attended a Sustainability workshop
attended various workshops offered by the TLC, also Anderson Conferences, etc
Attended GSA last year and GSOC meetings monthly.
I have attended NAGT and GSA, I attended the SAGE 2YC event that Eriks and Frank led at SE,
NAGT meetings, attended national SAGE 2YC workshop, led regional SAGE 2YC workshop, College liason of NASA Oregon Space Grant Consortium, worked with the IDES project and the UCORE project.
SERC workshop. Many hours spent in the field with students. ;)
teaching workshops NAGT field trip
NAGT, SAGE 2YC, OSGC, PCC Assessment Course, Qualtrics Training, and many personal trips to relevant PNW natural areas.
???

Statistic	Value
Total Responses	10

37. Have you applied for professional development funds?

#	Answer		Response	%
1	Yes		6	50%
2	No		6	50%
	Total		12	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.50
Variance	0.27
Standard Deviation	0.52
Total Responses	12

38. How would you rate the level of support for professional development activities?

#	Answer		Response	%
1	plentiful		0	0%
2	adequate		7	64%
3	measly		4	36%
4	non-existent		0	0%
	Total		11	100%

Statistic	Value
Min Value	2
Max Value	3
Mean	2.36
Variance	0.25
Standard Deviation	0.50
Total Responses	11

39. Comments

Text Response
I attempted to get funding for my trip, but missed the deadline due to my late decision to attend.
I am not sure how this works or what is available.
I applied for one grant to attend GSA and received it. Beyond that, I feel unable to comment.
I'm not really sure what's available for professional development funds. Do the travel grants for conferences count? I used that for going to NAGT.
I feel that the support in terms of money and substitute instructors is inadequate to regularly attend national meetings. I am having problems staying current in my field.
Unknown.
I have plenty of resources, but I'm not sure that all faculty members are treated equally regarding this issue. I would like to see more support for all members of the SAC to attend professional development workshops.

Statistic	Value
Total Responses	7

40. Where do you see our SAC and your involvement in five years?

Text Response
I hope the SAC will be strong with improved communication, organization, and collaboration across campuses. I hope I will still teach at PCC - would be great to have a full time position, or at least a full part-time schedule.
As my relationship with PCC grows, so too will be my involvment in making our department better
I would love to see more full time geolgy positions at PCC.
I hope we continue to develop a set of topic driven introductory courses with low level math prerequisites and that these courses evolve to focus on a few key science concepts which are carefully introduced and developed at the beginning of the course and then are used and applied repeatedly during the rest of the course. I hope the G 201/2/3 cluster evolves to stress the development of skills useful in upper level geology courses (mineral and rock ID, topographic and geologic map interpretation, Google Earth, Excel, GISy programs. I hope we get a full time instructor at Cascade. I hope we develop more on-line courses, including courses which include labs. I hope we keep incorporating field based learning and independent research into our curriculum. I hope we connect our students with internships, research opportunities and scholarships. I see myself continuing to be fully involved with the SAC.
In this economy...about the same...
I guess we'll be analyzing the results of this Program Review and determining what's best for future growth. I hope we can develop strong working relationships with all of our SAC members and inspire 100% participation at future SAC events both official and social. A collaborative team effort within the SAC will eventually result in enhanced student learning across PCC. I enjoy working with a team of professionals, so I hope I can assist in this process. It would be nice to have a full time faculty representative at each major campus, so I'd like to see a permanant position open up at Cascade by then.
Maintain what courses we have. We could do a better job at marketing all of our course and better interfacing with academic adivsors, etc.

Statistic	Value
Total Responses	7

41. Any other feedback or thoughts about the G&GS discipline at PCC you would like to share as the SAC begins to work on its program review?

Text Response
Drop a few jokes into the program review report to see if anybody reads the report.
We need more full time G/GS instructors. The ratio of FT G/GS faculty to chemistry and physics is absurd. :-/
G/GS Rocks!

Statistic	Value
Total Responses	3

42. Click to write the question text

#	Answer		Response	%
1	Click to write Choice 1		2	67%
2	Click to write Choice 2		1	33%
3	Click to write Choice 3		0	0%
	Total		3	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.33
Variance	0.33
Standard Deviation	0.58
Total Responses	3

APPENDIX 10
Table of G/GS face to face, DL, and hybrid courses

Table of G/GS face to face, DL, and hybrid courses

Course Number	Course Title	Offered as a distance learning class
GS 106	Physical Science (Geology)	hybrid - DL lecture, face to face (F2F) lab
GS 107	Physical Science (Astronomy)	hybrid - telecourse lecture, face to face (F2F) lab
GS 108	Physical Science (Oceanography)	hybrid - DL lecture, face to face (F2F) lab
GS 109	Physical Science (Meteorology)	hybrid - DL lecture, face to face (F2F) lab
G 148	Volcanoes and Earthquakes	--
G 160	Geology: Oregon Coast	--
G 161	Geology: Great Basin/Cascades	--
G 184	Global Climate Change	--
G 200A	Geology Field Studies	--
G 200B	Geology Field Studies	--
G 200C	Geology Field Studies	--
G 200D	Geology Field Studies	--
G 200E	Geology Field Studies: Mount St. Helens	--
G 200F	Geology Field Studies: Pacific Northwest Coast	--
G 200G	Geology Field Studies Columbia River Gorge	--
G 201	Physical Geology	--
G 202	Physical Geology	--
G 203	Historical Geology	--
G 207	Geology of the Pacific Northwest	DL
G 208	Volcanoes and Their Activity	DL
G 209	Earthquakes	DL
G 291	Elements of Rocks and Minerals	--
G 298A	Geology Independent Study	--
G 298B	Geology Independent Study	--
G 298C	Geology Independent Study	--