**General Education Annual Course Assessment Form**

**Course Number/Title**: GEOL112/ Hazards of Earthquakes & Volcanoes  
**GE Area**: R_Earth & Environment

Results reported for AY **2017-2018**  
# of sections **7**  
# of instructors **3**

**Course Coordinator**: Donald Reed  
E-mail: dreed@sjsu.edu

**Department Chair**: Jonathan Miller  
College: Science

**Instructions**: Each year, the department will prepare a brief (two page maximum) report that documents the assessment of the course during the year. This report will be **electronically submitted to <curriculum@sjsu.edu>**, by the department chair, to the Office of Undergraduate Studies, with an electronic copy to the home college by October 1 of the following academic year.

**Part 1**

To be completed by the course coordinator:

(1) What GELO(s) were assessed for the course during the AY?

**GELO 2**: Students will be able to distinguish science from pseudo-science.

**GELO 3**: Students are able to apply a scientific approach to answer questions about the earth and environment

(2) What were the results of the assessment of this course? What were the lessons learned from the assessment?

**GELO 2**

Three instructors, Reed, Veland and Turner, provided assessment data and will be described separately.

**Reed (4 sections)** - Following two online exercises on learning outcome #2, students reviewed examples of science of earthquake forecasting, as presented in the outcome of the U.S. Geological Survey Parkfield Experiment, versus pseudoscience of earthquake prediction that could be found on YouTube. They then described these examples in terms of the identifying characteristics of science and pseudoscience in a learning group discussion with their peers.

Of the students who passed the class, 115 of 121 achieved learning outcome #2 by earning 70% or higher on the content portion of the required online discussion, for an achievement rate of 95% for this learning outcome. Overall, students performed very well on the assignment.

**Veland (1 section)** – This learning outcome was approached by way of examining risk perception, where the students explored and discussed why people may not heed scientific findings and instead rely on pseudoscience that fits with their preconceived ideas about how the world works, and to reflect on how this might affect their own responses to scientific
information about earthquake and volcanic hazards. The results of student work on several assignments, including postings in a learning group discussion, two classroom activities, questions on two quizzes, and a pair-share reflective activity were combined to estimate a 74.4% achievement rate for the entire class. Unfortunately, rates of student participation on these assignments varied from 100% to 67% of the class, depending on attendance of the particular day of the assignment.

**Turner (2 sections)** - Following lectures on the scientific method, prediction methods for volcanoes, and predicting earthquakes; and having just watched a portion of an episode of “Last Week Tonight” on the topic of scientific studies, students were divided into small groups to discuss pseudoscience. They were given a short list containing some scientific evidence and some pseudoscientific beliefs. As a group, they discussed whether each listed item is based in science or pseudoscience, and if it is pseudoscience, where does it fail the scientific method. They then came up with a few other pseudoscientific beliefs on their own and again analyzed them using the scientific method. A class-wide discussion followed with each group sharing the pseudoscientific beliefs that they came up with and the class ultimately reached a consensus as to which of the listed items are in fact supported by scientific evidence. A question on the final exam had students identify whether or not certain earthquake prediction methods were scientific or pseudoscientific. Combining the results of the two sections, revealed that 64 of the 71 students answered the final exam question correctly for a learning outcome achievement rate of 90% of the students.

**GELO 3**

**Reed (4 sections)** – Students participated in a 90 minute-long walk along the trace of the Hayward Fault in Fremont, CA to make visual observations and collect measurements of ground deformation due to recent fault slip, both seismic and aseismic. Students who could not attend the walk used a virtual tour of the Hayward Fault, developed on the U.S. Geological Survey, and viewed with Google Earth (https://earthquake.usgs.gov/learn/topics/haywardfault/), showing some of the same features. Students in the latter group were required to make many of the same observations and collect measurements from photographs at 24 stops along the Hayward Fault between Richmond and Fremont. In both formats, whether using virtual tour or the walk, the collected observations were then combined with GPS measurements of ground displacement and patterns of recent and historical earthquakes, both available from online databases at UNAVCO and the U.S. Geological Survey, to study the processes of seismic slip and aseismic creep, which were then placed in the context of earthquake probability forecasting. This research was written up in a scientific report describing recent activity along the Hayward Fault and implications for seismic hazard analysis. The format of the report closely followed that of peer-reviewed scientific research journals in the geosciences. The assignment was assessed based on a clear statement of the research question that was addressed, a description of background information, the quality and diversity of evidence presented (measurements, photos, references), and the strength and correspondence of their conclusions with the evidence presented.

Out of 120 students who completed the assignment, 116 achieved the learning outcome by earning 70% or higher of the possible points. The average score was 84% of possible or very good work in achieving the learning outcome.
**Veland** (1 section) – students enrolled in this section completed the same assignment as described under Reed’s section above, and the relationship to the desired learning outcome was assessed using the same criteria. Out of the 30 students in the section, 29 completed the assignment with 24 achieving the learning outcome. The reports of five students did not reach the level of achievement.

**Turner** (2 sections) - Students are assigned a Plate Boundary Observatory GPS station in California to analyze time series data (compiled by UNAVCO) to determine the direction and speed of ground displacement, which reflects the movement of the underlying tectonic plate at their station. Students learn to interpret the time series data by plotting the North and east component vectors of motion. Students ultimately determined the velocity of the plate at each station with the results of the entire class being compiled into Google Earth to examine the relative rate of movement between the Pacific and North American Plates. Groups of 2-3 students are assigned the same station. Students are required to do their own work but asked to come to a group consensus on the final velocity of their station so it can be added to the Google Earth map.

This is a two part assignment. The scores for the first part (GPS station part) were used to determine achievement of the learning objective. Out of the 68 students in the class, 65, or 95.6% of the class, achieved the learning outcome by identifying the objective of the their understanding the context in which to place their results, collecting and analyzing quantitative data from an online data base, and reaching a conclusion that was derived directly from their analysis. The average score on the exercise was 80% of the possible points.

(3) What modifications to the course, or its assessment activities or schedule, are planned for the upcoming year? (If no modifications are planned, the course coordinator should indicate this.)

**GELO 2**

**Reed** (4 sections) - No modification planned except to emphasize that a negative result of a hypothesis test is scientifically important because some students perceive a negative result as indicating pseudoscience when, in fact, a negative result is important to invalidate some speculations.

**Veland** (1 section) – The use of additional case studies such as L’Aquila, Krakatoa, and Mexico City would be helpful in shaping student awareness of risk perception and related pseudoscience. Having one graded written assignment (rather than one among many questions on an exam or weekly quiz) would demand all students to engage with the topic and thus improve participation and understanding.

**Turner** (2 sections) - Incorporate a first-day pre-test quiz into Canvas in order to track individual students understanding throughout the semester.

**GELO 3**

**Reed** (4 sections) – This assignment has shown to be highly successful in achieving the desired outcome with students making their own scientific observations and measurements, integrating these data with available online data used by practicing scientists in the discipline,
and then writing up the results in a scientific report. However, more emphasis could be placed on making quantitative measurements during the field study portion of the research, followed by an error analysis. 

**Veland** (1 section) – no modifications, except possibly assisting students with transportation to the study area.

**Turner** (2 sections) - Currently, students have the option to use a downloadable csv file of the GPS date to calculate the component vectors. I will be removing this option so students can better conceptualize why the slope of each plot allows them to determine the annual movement rate.

**Part 2**

To be completed by the department chair (with input from course coordinator as appropriate):

1. Are all sections of the course still aligned with the area Goals, Student Learning Objectives (GELOs), Content, Support, and Assessment? If they are not, what actions are planned?

   All sections of Geol 112 are still aligned with the GELO’s.

2. If this course is in a GE Area with a stated enrollment limit (Areas A1, A2, A3, C2, D1, R, S, V, & Z), please indicate how oral presentations will be evaluated with larger sections (Area A1), or how practice and revisions in writing will be addressed with larger sections, particularly how students are receiving thorough feedback on the writing which accounts for the minimum word count in this GE category (Areas A2, A3, C2, D1, R, S, V, & Z) and, for the writing intensive courses (A2, A3, and Z), documentation that the students are meeting the GE GELOs for writing.