CAS GE to LE Core Application

Preparer(s)

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Section I. CAS GE to LE Core Application Cover Sheet

Department/Program: Geology

Effective year and term for implementation of action: [2016]Fall

Current Course Information

Prefix:	Number:	Credits:
GEOL	102	3

Catalog Title: Oceanography

Section II. Application for Inclusion in the Liberal Education Core

A. This course addresses the following Liberal Education Core Learning Outcome(s) (check all that apply):

Knowledge	☑ K1	☐ K2	☐ K3	☐ K4
Skills	☐ S1	☐ S2	☐ S3	
Responsibility	☐ R1	☐ R2	☐ R3	
Integration	☑ I1			

B. Provide the requested information for each identified learning outcome.

Knowledge 1 (K1): Describe and evaluate models of the natural and physical world through collection and scientific analysis of data, and through the use of mathematical or computational methods.

1. Describe the content of the experience and especially the relationship between the content and the identified learning outcome. If it is appropriate, estimate the percentage of time spent in the experience on the identified outcome.

Oceanography is a course integrating concepts from geology, chemistry, physics, astronomy, geography, and biology to understand the world's oceans. The first third of the course is largely physical geology (geological time and plate tectonics). The second third of the course addresses the chemistry of water, and then how that water is set into motion (chemistry, meteorology, ocean currents, waves, and tides). The last three weeks of the class is devoted to marine biology and how life forms have adapted to thrive under harsh marine conditions.

The entire class is devoted to integrating all of the natural sciences, as well as some social sciences, to understand the ocean system. To consider what percentage of the class is devoted to the K1 outcome and the IL1 outcome seems entirely artificial. I do not want to put evaluation of the natural world and integration into "silos." Thus, I'll say 100% of the class is devoted to the K1 and IL1 learning outcomes.

2. Describe the opportunities that the experience will offer students to meet the identified outcome. Your description can include pedagogy used, example assignments, broad discussion of the learning environment for the experience, etc.

Students commonly think of natural science as a set of facts to memorize. I strive to teach foundational scientific concepts that are useful to investigate and explain processes. Ideas such as deep geological time and plate tectonics are not taught as "facts." Rather, students use the scientific method (basically a logical framework to investigate the earth) to 1) determine what types of evidence are necessary to support the theories, and 2) evaluate actual data/evidence to determine the scientific merit of these, and other, theories.

Although the course sections are very large (60-140 students), I pepper students with questions and ask them to integrate knowledge from many disciplines and to defend their answers logically. If a student provides an incorrect answer, I try to go back to concepts of geology, chemistry, physics, astronomy, and/or biology to help him/her determine where they went wrong. In many cases I will ask other students to work through the steps necessary to answer the question correctly. This helps me assess student learning as we go.

I have utilized concepts learned from Dr. Barbara Tewksbury, Hamilton College (NY), about effective means to help students apply concepts during class time. Once I have introduced a topic and we have worked through some examples, students work in pairs to evaluate new data/situations. As an incentive, they are told that groups will be selected to come to the front of the classroom and teach the concept to the class. (This tends to motivate them…!) Then I select groups to teach the class under my watchful eye. If they make mistakes along the way, I guide them to the appropriate concepts of geology, geography, chemistry, physics, astronomy, and/or biology so they can use their critical-thinking skills to determine the proper answer. In addition, we consider political/economic issues when discussing the impacts of climate change, rebuilding dikes in New Orleans, and government-sponsored flood insurance. I also have students work in groups on four pop quizzes during a semester to see if students are integrating their scientific knowledge to better understand the world's oceans.

Office hours are used extensively to develop critical thinking skills. I find that students want to memorize garbage rather than understand concepts. Quizzing students in the office about oceanographic concepts is a major component of the class. Many students accept this offer during the 1 to 2 weeks before exams.

3. Identify and provide a rationale for the presence of all prerequisites.

No prerequisites.

4. Describe the student work for the identified outcome that will be collected, assessed and results submitted to the University Assessment Committee for purposes of assessment of our Liberal Education Core. Examples of student work include student papers, in-class writing, exams, field experiences, oral presentations, etc.

Be sure to refer to the outcome rubric elements in relation to the student work that will be assessed. If there are aspects of your course that align with a

selected learning outcome but are not well-reflected in its rubric, provide relevant commentary.
Grades for the class will be based on three multiple-choice exams, four short-answer pop quizzes, and a writing assignment. For a large-enrollment class such as this, most of the grade will be based on exams.

The short-answer pop quizzes will be assessed using the LE Core Rubrics for K1. The writing prompt will give students an oceanographic model to evaluate. Students will need to use concepts of geology, chemistry, physics, astronomy, and/or biology appropriately to describe and evaluate the model (K1-A&B), and then evaluate whether the analyzed data supports the model (K1-C).

Below I supply two short-answer pop quiz questions I have used previously to assess if students clearly understand oceanographic models. The questions are in italics, and my comments follow each part of the question.

The Mid-Oceanic Ridge question
1. Draw a cross section diagram (side view) of a mid-oceanic ridge. Label the diagram. Students need to know the geological model to draw the diagram. K1-A
2. Briefly explain why the MOR is a ridge. In order to answer this, students need to understand that the geological divergence (rifting--geology) causes melting and volcanism. The volcanism makes the new lithosphere hot, so molecules move rapidly (chemistry—this is the definition of "high temperature") and expand (an application of the temperature concept), so density decreases and the hot lithosphere floats upward (the three-star cork concept) and becomes a high area (this is the physics concept of buoyancy taught in the course). K1-A&B
3. What is the earthquake signature for an MOR (depth and magnitude) & why? Students need to know the plate tectonic model and how oceanic lithosphere is thin. The lithosphere is the more brittle part of the earth so it can snap and cause earthquakes. Because the brittle material is thin, the earthquakes are shallow (a term that is defined very specifically in class). However, students also need to understand that the temperature of a material is a major control on brittleness (a function of chemistry, and what I call the glassblower three-star concept). Because the new oceanic lithosphere is quite hot (because of the volcanism), the material tends to bend rather than snap and the earthquakes are relatively weak. K1-C – here the students are using the model to predict what the data should look like if divergence is occurring at the mid-oceanic ridge.
4. What specific type of plate boundary is this?

The Prevailing Wind question
Please explain the prevailing winds between 90o North and 60o North latitude. You must do the following:
1. Explain the atmospheric pressure at 90o North latitude. What is the atm. pressure and why? Solar radiation input is low because of earth-sun geometries (geography, astronomy), so the area is cold. As in the plate tectonic question, cold temperatures mean slow molecular velocity (chemistry), the atmosphere contracts, density increases, and the air sinks (three star cork concept). High density air is a high atmospheric pressure cell. K1-A&B
2. Provide a well labeled diagram and a very brief verbal explanation of the processes causing the winds. Low atmospheric pressure is located at 60 degrees North latitude. Winds move from high pressure to low pressure (physics), and then are deflected by Coriolis Effect (physics). Students can then compare this with the prevailing winds in this latitudinal band (polar easterlies) and see that they have predicted the proper wind direction. K1-A, B, & C
3. Name the wind compass direction using the standard convention. Students need to know the meteorological convention for describing the winds (the direction from which the wind comes).

5. Provide additional information on the learning experience such as:
- **Sample readings**
- **Topical outline and timetable**
- **Learning outcomes**
- **A brief description of the experience (300 words maximum)**

Sample readings
Readings will come from the textbook for the course. In addition, web links will be sent to students when important oceanographic events are in the news (hurricanes, tsunamis, oil spills, earthquakes, volcanic eruptions, fisheries regulations, etc.)

• Topical outline and timetable
History of Oceanography -- 1 week
Geological time -- 1 week
Origin of the ocean basins, shape of the sea floor, plate tectonics, volcanism -- 4 weeks
Chemistry of water -- 1 week
Atmospheric and ocean circulation -- 3 weeks
Waves and tides -- 2 weeks
Marine biology -- 3 weeks

• Learning outcomes. Students will:
Describe the dynamic, interdisciplinary nature of the field of oceanography.
Describe evidence used to develop the geologic time scale.
Evaluate major scientific theories using scientific data.
Use foundational scientific concepts and critical-thinking skills to predict the behavior of oceanographic systems.

• A brief description of the experience (300 words maximum)
This course will require students to integrate concepts from geology, chemistry, physics, astronomy, biology, and the social sciences to understand the world's oceans and their impacts on humans. Students will repeatedly use foundational scientific concepts and logic to evaluate new aspects of the ocean system. As they break complex problems down into more manageable parts, students will hone the critical-thinking skills necessary to explore other questions. In addition, classroom learning will be connected to natural disasters and political controversies in the news. Ultimately, it is hoped students will see science not as a collection of facts, but rather as a way of observing and investigating the world.

6. Considering existing department/program resources, please provide answers to the following:

How many sections of the experience will be offered in the fall semester? One section, 140 students

How many sections of the experience will be offered in the spring semester? Two sections while Syverson is chair, 200 seats total. When Syverson is not chair, zero seats will be offered in the spring.

What will be the average size for each section of the experience? see above

Integration (I1): Apply knowledge, skills or responsibilities gained in one academic or experiential context to other contexts.

1. Describe the content of the experience and especially the relationship between the content and the identified learning outcome. If it is appropriate, estimate the percentage of time spent in the experience on the identified outcome.
See K1_1 above.

2. Describe the opportunities that the experience will offer students to meet the identified outcome. Your description can include pedagogy used, example assignments, broad discussion of the learning environment for the experience, etc.
As mentioned in the K1_2 section, students commonly think of natural science as a set of facts to memorize. As such, they commonly do not see the relevance of scientific learning to their lives. Everything I do in Oceanography is to integrate their learning in Geology 102 with things they have learned in chemistry, biology, astronomy, geography, physics, history, and political science. If they have not had any of these courses previously, this course does introduce/connect/reinforce specific theories and concepts for each of the disciplines identified above.

I also tell them that I will be teaching logic in the class. Many students do not believe that before the first exam, and then they understand that broad foundational knowledge and good logic are necessary to thrive on my exams! In my opinion, the transfer of logical-thinking skills from this class to other classes (and life in general) is the greatest gift I can give my students.

The examples used in K1_2 can be used to facilitate integration as well. I'll provide one example here. Most students have gone to a river, lake, or ocean on a hot day because the water is cool. Why? It is all chemistry. Hydrogen bonding (chemistry) causes the water molecules to stick together, so they cannot easily speed up and therefore cannot increase in temperature easily (high heat capacity). The surrounding land with a low heat capacity increases in temperature quickly, so people flock to the beach on a hot day. This also causes refreshing cool breezes off the lake or ocean (chemistry, physics, meteorology, which is explained using similar logic to that used in the Prevailing Wind question in K1-4). This keeps temperatures "cooler near the lake" – a statement students have heard many times during weather broadcasts if they visit a coastal area. If students transfer the chemistry knowledge they learn in the plate tectonics part of the course, they can understand sea breezes. This surprises students who do not realize that foundational scientific principles are valuable tools to evaluate new situations.

3. Identify and provide a rationale for the presence of all prerequisites.
No prerequisites. I do not assume any prior knowledge of geology, chemistry, physics, biology, geography, or astronomy. However, I stress to them that they need to understand these disciplines as presented/discussed in class, and then use that knowledge to solve new problems.

4. Describe the student work for the identified outcome that will be collected, assessed and results submitted to the University Assessment Committee for purposes of assessment of our Liberal Education Core. Examples of student work include student papers, in-class writing, exams, field experiences, oral presentations, etc.

Be sure to refer to the outcome rubric elements in relation to the student work that will be assessed. If there are aspects of your course that align with a selected learning outcome but are not well-reflected in its rubric, provide relevant commentary.
Grades for the class will be based on three multiple-choice exams, four short-answer pop quizzes, and a writing assignment. For a large-enrollment class such as this, most of the grade will be based on exams.

I have long been intentional about integration in my Oceanography class. Thus, I think inclusion of this class for "Integration" Liberal Education category is a natural one. Let me demonstrate using the Prevailing Wind short-answer question discussed in K1_4.

The Prevailing Wind question
Please explain the prevailing winds between 90o North and 60o North latitude. You must do the following:
1. Explain the atmospheric pressure at 90o North latitude. What is the atm. pressure and why? Solar radiation input is low because of earth-sun geometries (astronomy), so the area is cold. As in the plate tectonic question, cold temperatures mean slow molecular velocity (chemistry), the atmosphere contracts, density increases, and the air sinks (three-star cork concept). High density air is a high atmospheric pressure cell. This allows students to make great connections between the disciplines of astronomy, chemistry, and oceanography. (I-B)
2. Provide a well labeled diagram and a very brief verbal explanation of the processes causing the winds. Low atmospheric pressure is located at 60 degrees North latitude. Winds move from high pressure to low pressure (physics), and then are deflected by Coriolis Effect (physics). Students can then compare this with the prevailing winds in this latitudinal band (polar easterlies) and see that they have predicted the proper wind direction. Now students can use information gained using astronomy and chemistry (part 1 of the question), add some concepts of physics, and suddenly the prevailing winds emerge. As an instructor it is fun to watch students figure this out – for some students it almost seems magical to see their predictive ability in action. (I-B)
3. Name the wind compass direction using the standard convention. Students need to know the meteorological convention for describing the winds (the direction from which the wind comes).

In my opinion, elements I-A and I-C are at the heart of Liberal Education (and General Education as well). Also, these are not necessarily easily assessed using scientific writing prompts. A few years ago a former dean (Marty Wood) challenged us to become more intentional about General Education at UW-Eau Claire. Thus, I instituted a pre-course and post-course reflection writing assignment, and I think these two writing assignments capture the spirit of elements I-A and I-C.

Here is the prompt given the first day of class:
You are enrolled in Oceanography (Geology 102). Most students enrolled in the class will not become professional oceanographers. However, what do you hope to learn in this course? How does this course fit into your entire educational experience at UW-Eau Claire? (Don't tell me that it provides GE-II natural science credits!) How do you think this course can benefit you as an educated person ten years after you graduate from college?
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Typically the answers are quite generic (I just read them last night) – the class will help them be well rounded, might help them if they work for an international business, help their kids with homework, etc. However, many students talk about prior experiences with the oceans and geology (tides are most commonly mentioned, but so are encounters with large waves, earthquakes, and biological life, I-A). As I read these pre-course reflections, I consciously think how I can relate course content to student experiences (I-A).

In the last week of class, I assign the following question as the final "pop quiz", and students are given two days to write their answer and submit it to me. Here

is the prompt:
Please reflect on the questions below and answer the questions in a couple of well written, typed paragraphs. Your answer must be double-spaced and less than one page in length! Your reflection must be printed and handed in at lecture on Friday December 12. Your score will be based on the quality of the writing. If you cannot see how this course will benefit you as an educated person, clearly explain why and you can still receive all of the points for the pop quiz! I will read your reflection and record its completion in my grade book.

You have nearly completed this course in Oceanography (Geology 102). You probably won't become a professional oceanographer. However, how do you see this course fitting into your entire educational experience at UW-Eau Claire? What have you learned in this course that will benefit you as an educated person ten years after you have graduated from college?

Don't tell me if you liked the course, if I'm a jerk, etc.! That will be done in the official course evaluation! I want you to reflect on how this class fits into the "big picture" with regards to your education – and life.
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The answers to the question at the end of the semester tend to be VERY different. Many students say they tried to memorize "facts" for the first exam, and then discovered that this did not work. They commonly mention how they started to learn and understand "three-star concepts" from many scientific disciplines, and then by applying sound logic they were able to understand the world's oceans in a meaningful way. They see that asking questions such as "What's your logic?" and "Why?" and "Who cares?" helps them break down big problems into manageable parts and leads to potential solutions. (I-A, B, & C) In addition, students commonly mention that the oceanographic phenomena they previously had observed could be explained using scientific content (and logic) learned in this class. (I-A)

Interestingly, many students each semester tell me they started looking for foundational "three-star concepts" in other classes. They identified these "three-start concepts," studied them, and told me their academic performance improved. Who would think that understanding foundational concepts would help them understand some aspects of past academic struggles and help them improve academic performance?! (I-A & C)

This summer I had the honor of being invited to a wedding where both the bride and groom were former Oceanography students. At the wedding reception, I asked the groom if he had ever used his oceanographic knowledge after the class ended. His answer warmed my heart. He said that when he and his fiancé discussed a problem/issue, they commonly ask each other, "What's your logic?" They had obviously applied their skills and methodologies into a different experiential context. (I-C)

5. Provide additional information on the learning experience such as:
- **Sample readings**
- **Topical outline and timetable**
- **Learning outcomes**
- **A brief description of the experience (300 words maximum)**

See K1_5 above.

6. Considering existing department/program resources, please provide answers to the following:

How many sections of the experience will be offered in the fall semester? See K1_6

How many sections of the experience will be offered in the spring semester? See K1_6

What will be the average size for each section of the experience? see above

Attachments

General Notes and Comments:

Date of Department/Program Approval (Include all department/program names and approval dates as appropriate):
August 26, 2015 -- Dept. of Geology

College Curriculum Committee or Equivalent Action:
10/22/2015 ◉ Approved ○ Denied

University Liberal Education Committee Action:
○ Approved ○ Denied