Annual Program Assessment Report

Academic Year Assessed:

College:

Department:

Submitted by:

Program(s) Assessed:
Indicate all majors, minors, certificates and/or options that are included in this assessment:

Majors/Minors/Certificate	Options
Environmental Science undergraduate degree	Environmental Sciences, Environmental Biology, Geospatial & Environmental Analysis, Land Rehabilitation, Soil and Water Sciences

Annual Assessment Process (CHECK OFF LIST)

1. Data are collected as defined by Assessment Plan
    YES__X___   NO_____

2. Population or unbiased samples of collected assignments are scored by at least two faculty members using scoring rubrics to ensure inter-rater reliability.
    YES_____   NO__X___

3. Areas where the acceptable performance threshold has not been met are highlighted.
    YES__X___   NO_____   NA_____

4. Assessment scores were presented at a program/unit faculty meeting.
    YES__X___   NO_____

5. The faculty reviewed the assessment results, and responded accordingly (Check all appropriate lines)
    Gather additional data to verify or refute the result. _____
    Identify potential curriculum changes to try to address the problem __X___
    Change the acceptable performance threshold, reassess _____
    Choose a different assignment to assess the outcome _____
    Faculty may reconsider thresholds_____
    Evaluate the rubric to assure outcomes meet student skill level _____
    Use Bloom's Taxonomy to consider stronger learning outcomes _____
    Choose a different assignment to assess the outcome_____
    OTHER: We will review our learning outcomes this year, as we start the cycle over.

6. Does your report demonstrate changes made because of previous assessment results (closing the loop)?   YES_____   NO__X___

1. **Assessment Plan, Schedule and Data Source.**
   a. Please provide a multi-year assessment schedule that will show when all program learning outcomes will be assessed, and by what criteria (data). (You may use the table provided, or you may delete and use a different format).

Our undergraduate learning outcomes include the following:
1. An understanding of core theoretical principles and applications in evolutionary, ecological and physical environmental sciences.
2. Ability to access, read, and critically assess the quality and source of environmental information.
3. Knowledge of the theory and practice of data analysis in environmental sciences, including statistical analysis, model building, and graphical presentation of data.
4. The ability to write and present scientific material effectively.
5. An understanding of the ethical implications of conducting and applying environmental science.

ASSESSMENT PLANNING CHART					
PROGRAM LEARNING OUTCOME	2017-2018	2018-2019	2019-2020	2020-2021	*Data Source**
Outcome 1	X		X		Questions embedded in an exam ENSC 468
Outcome 2	X	X			Student presentations in ENSC 201 Student papers in ENSC 499
Outcome 3		X			Specifically-designed survey in ENSC 448
Outcome 4	X	X			Student presentations in ENSC 201 Student papers in ENSC 499
Outcome 5	X		X		Student homework assignment in ENSC 245

b. What are your threshold values for which you demonstrate student achievement? (Example provided in the table should be deleted before submission)

Threshold Values		
PROGRAM LEARNING OUTCOME	Threshold Value	Data Source
We have established rubrics for each of the learning outcomes that can be ranked from 1 (low) to 4 (high).	The threshold value for this outcome is for 80% of assessed students to score above 2 on a 1-4 scoring rubric.	The data source varies with the class being used for the assessment, but includes papers, presentations, and embedded questions.

2. What Was Done

a) Was the completed assessment consistent with the plan provided? YES_____ NO___X__
If no, please explain why the plan was altered.

Our goal was to assess the third learning outcome, that students will have a knowledge of the theory and practice of data analysis in environmental sciences, including statistical analysis, model building, and graphical presentation of data. ENSC 468 is designed specifically for students to work independently on a research project, proposing a hypothesis to test, designing an experiment in the field, gathering data, analyzing that data, and making a final presentation. While the easiest assessment would have been to evaluate final papers or presentations, after much deliberation we decided that we would miss what we truly wanted to learn.

To assess this outcome, we surveyed students in a senior-level course (ENSC 448: Stream Restoration Ecology). The course is designed to encourage students to master, integrate, and apply the concepts and skills they have learned across the arc of their undergraduate experiences. In the course, students identify a research question, develop a hypothesis, make a prediction, develop a field data collection methodology to assess the prediction, draw inference about their original hypothesis, and present the results in the form of an on-line research report modeled after a conventional scientific paper (abstract, introduction, methods, results, discussion, and conclusion).

The survey assessed: 1) prior student preparation for the data analysis tasks required by ENSC448; 2) the effectiveness of the course in building atop skills and knowledge gains in prior coursework, and 3) the overall effectiveness of the combination of prior coursework and the specific ENSC448 experience in meeting the department's desired learning outcome.

Overall preparation prior to ENSC448

Question 1: How well prepared and confident did you feel at the beginning of the class to accomplish the data management and analysis tasks you were asked to perform? (1 = "Hardly Prepared;" 5 = "Fully Prepared.

11 responses
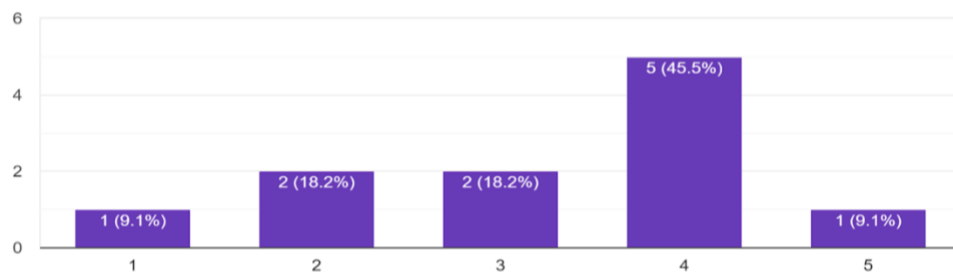
Question2: Regardless of your preparation/confidence level, how much of your data management and analysis skills that you had were learned in *classes you took as part of your college curriculum*? (1 = "Acquired most of my skills outside classes;" 5 = "Acquired most of my skills in my college classes.")

11 responses
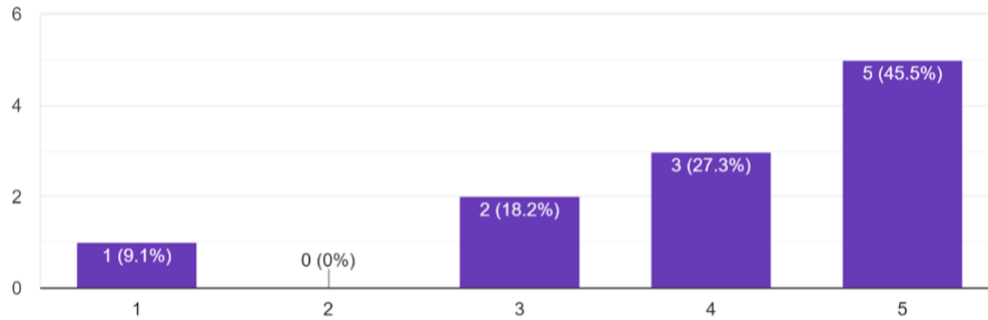
Question 3: Consider the fraction of your data analysis skills that you learned from your college curriculum... Which classes did you take that were most helpful in honing theses skills? Briefly describe which helpful skills you learned in each class you list.

Question 4: What data analysis and management skills did you need in LRES448, but would have been helpful if provided as part of your college course work?
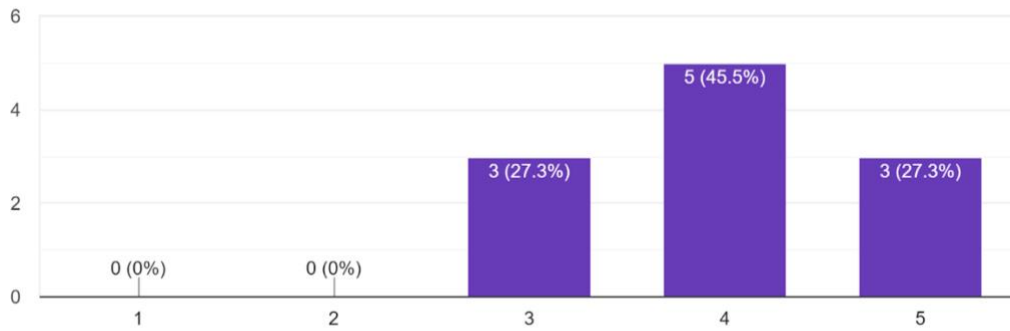
Summary of responses: Prior preparation

With a few exceptions, students felt sufficiently prepared for the data analysis aspects of the research project they were required to perform in ENSC448. Most of the preparation came from their undergraduate work, especially in statistics course. The importance of mastering the R statistical computing environment was a common theme throughout the student comments. While likely accurate given that most statistics courses use R, the survey could have been somewhat biased by the fact that the course TA was especially well versed in R and encouraged students toward that solution.

**Effectiveness of skills integration and application in ENSC448.**

Question 5: How much did the information you learned in LRES448 **lectures** improve your capacity to analyze data? (1 = not at all; 5 = substantially.)

Question 6: How much did the challenge of being asked to collect and analyze your own data set improve your understanding and skills in data management and analysis? (1 = not at all; 5 = substantially.)

11 responses
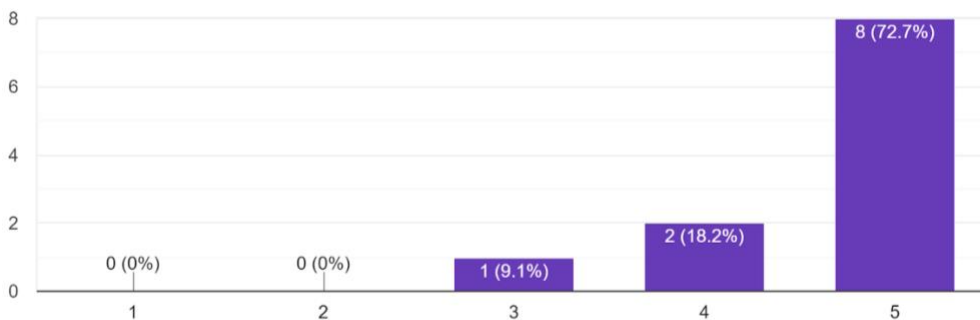
Summary of course effectiveness

Students felt that the lecture material in ENSC448 was helpful to polish what they learned in prior courses. The course provides lectures that describe, conceptually, how various statistical approaches work, what statistical comparisons are made by various different tests, and tips for identifying which basic families of statistics are applicable for different research designs. Perhaps not surprisingly, the exercise of applying statistics to a research question of the student's own design and associated data collected by the student was an especially effective teaching approach.

Overall effectiveness of the combined curriculum.

Question 7: How much did you rely on the course TA (or another person) to manage, analyze, and display your data for your ENSC448 research project?
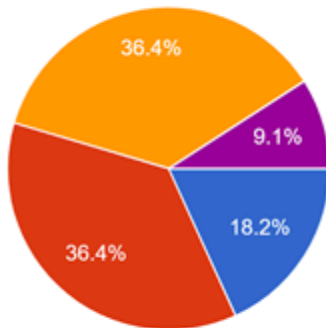
- ● I figured it out on my own.
- ● I got a little help in a few places, but did most of the work.
- ● I required quite a bit of help, but feel like could do a similar analysis largely on my own.
- ● I required quite a bit of help, and even so I still feel a little lost about how to conduct data analysis
- ● The TA (or another person) pretty much did my analysis for me; yet I feel like I can interpret the results.
- ● The TA (or another person) pretty much did my analysis for me; I still don't get it.

Question 8: How confident do you feel that your data analysis is statistically rigorous and was conducted correctly? (1 = "Not at all confident;" 5 = "Quite confident."

11 responses
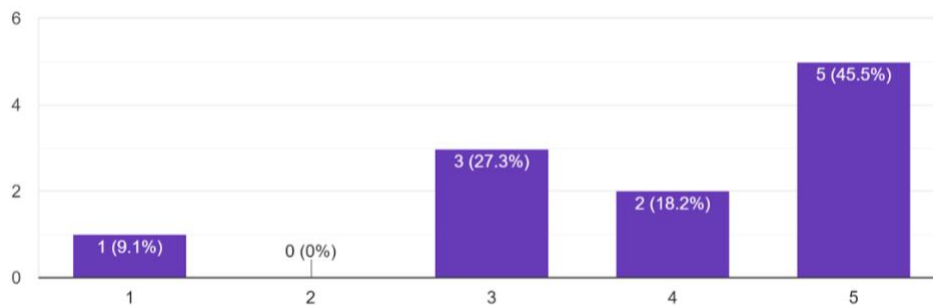
Question 9: In which aspects of your data management, analysis, and display do you feel confident? In which aspects do you lack confidence?

Summary of effectiveness of combined curriculum

After analyzing their data sets, students generally felt confident in their results and their ability to conduct a similar data analysis in the future. Overall, about half of the class conducted the analysis rather independently, and half required substantial assistance from classmates or the course TA. Yet only 1 of 11 students survey felt as though (s)he would not be able to conduct a similar analysis in the future. Most students felt confident that their analysis was conducted correctly. Overall, these results suggest that students were at least adequately prepared to undertake the class exercise of research design, implementation, and associated data analysis.

The results of this survey are largely consistent with the instructor's assessment of the students in the course, with the caveat that the reports produced by the students (in which they reported and

interpreted their statistical analyses) were perhaps a shade less rigorous/accurate that might be reflected in this survey. Yet overall, both the instructor's observations and the survey results suggest that application of statistical analysis in the context of student-designed research projects represents high quality, high-impact practice related to undergraduate research and teaching. The final reports compiled by the students in ENSC448 showed a level of mastery of statistical analysis that was appropriate for students completing their undergraduate education. Further, as reflected in the survey, the students' desire to know if their hypothesis-based predictions were affirmed by the data they collected provided important motivation for the students to apply themselves to improving their capacity to understand and perform statistical analysis.

b) Please provide a rubric that demonstrates how your data was evaluated.
Given that our assessment was based on a survey, our evaluation did not lend itself to a rubric. We are working to customize the assessment to provide us with information that will help us understand how our students are learning, and where we need to improve. While for some learning outcomes, the approach outlined by the Provost's office is very useful, there is additional information that we need that can't be gleaned from a class exercise.

3. How Data Were Collected
a) How were data collected? (Please include method of collection and sample size).
The survey was created and students were asked to complete the survey. The results summarized above are from 11 of the 18 students.

b) Explain the assessment process, and who participated in the analysis of the data.

Geoff Poole compiled the data, and two faculty (Geoff Poole and Cathy Zabinski) reviewed and discussed the data, to determine the best way to present it.

4. What Was Learned
Based on the analysis of the data, and compared to the threshold values provided, what was learned from the assessment?

a) Areas of strength

By engaging in active, hands-on, self-directed learning in a supportive environment, virtually all students felt an improved confidence in their capacity to conduct data analysis. In the final question, many students revealed a nuanced understanding of basic statistical concepts, expressing confidence in their capacity to interpret the results, healthy skepticism about whether every aspect of their analysis was entirely reliable, and varied confidence in their ability to run the statistical tests without some assistance. Overall, students appear literate in interpretation of statistics, empowered to perform similar analyses in the future, but with an important grasp of the limits of their expertise in light of all there is to know about statistical analysis.

b) Areas that need improvement

More experience coding, programming, and in statistical training were the ubiquitously identified by the students as desires for additional training.

5. How We Responded
a) Describe how "What Was Learned" was communicated to the department, or program faculty. Was there a forum for faculty to provide feedback and recommendations?

We have completed an assessment of all of our learning outcomes, and part of our Fall Semester tasks is for the departmental outcomes assessments committee to revisit our learning outcomes and make recommendations that will be presented to the faculty.

b) Based on the faculty responses, will there any curricular or assessment changes (such as plans for measurable improvements, or realignment of learning outcomes)?
YES__X____   NO_____

 If yes, when will these changes be implemented?

   We have modified our capstone course to specifically address the topic of Ethics in Science, in part as a response to our assessment of our fifth learning outcome, that students will gain an understanding of the ethical implications of conducting and applying environmental science. That course is being taught this fall, and a randomly selected subset of the final presentations will be assessed by two faculty members.

6. Closing the Loop
a) Based on assessment from previous years, can you demonstrate program level changes that have led to outcome improvements?

Our assessment this fall will allow us to compare our students' performance relative to Outcome 5. Because our students met the thresholds we identified for the other outcomes, we don't necessarily have data that suggests that we need to make changes. Rather, we will focus our efforts on improving our approach to assessment, to make sure we are getting the information that is most useful for helping us to determine whether our students are meeting the learning outcomes we have defined.

Submit report to programassessment@montana.edu