

Redesigning a GenEd Science Lab Using Earth System Science

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The key to success in developing a conceptually diverse laboratory is a broad base of contributors having a variety of educational and life experiences



Introduction to Environmental Science (ES 110) was redesigned to include a laboratory using funds from NASA ESSE21, and now is offered as a 4-credit course that fulfills the general education science requirement. The lab teaches Environmental Science using an Earth system science approach. Unlike a Biology or Chemistry laboratory, an Environmental Science laboratory touches on concepts from a wide variety of disciplines. The key to success in developing a conceptually diverse laboratory is a broad base of contributors having a variety of educational and life experiences. The diversity in contributors helps to insure that all aspects of the multidisciplinary material are handled by someone proficient in that area. In practice we also found that as a team we are able to relate the subject matter to a wider variety of students. Since this course now fulfills a

general education requirement, we anticipate more students from a variety of different majors will be taking this class. So, not only is the subject matter diverse, but the student population in the class is diverse as well. The diversity in the intended audience, combined with the range of potential subject matter, presented an intriguing task that resulted in a challenging and interesting laboratory experience.

To provide a fuller understanding of the nature of the Earth system and its importance to the human subsystem, a broad spectrum of subjects was presented. Individual modules included water quality, soil as a filter, soil erosion, microbes, dust and aerosols, remote sensing, and energy sources. Throughout the course students were asked to explore how the topic of the week's lab might relate to them both personally and professionally. In the final lab, students selected one lab topic from the semester that particularly interested them. They investigated that topic in greater depth and presented their ideas and findings in a PowerPoint presentation to the rest of the class.

We created an active learning environment by incorporating a variety of activities, learning styles, and class settings. Field trips around campus gave students the opportunity to test water quality at several locations and to visit the campus power station to see how NMSU meets its energy needs. Hands on activities included building landscape models to demonstrate erosion, and building solar powered cars to look at alternative energy sources. There were wet labs utilizing microscopes to explore



some of the microbes commonly found in our food and water, and the use of columns packed with different soils to demonstrate ion exchange properties. Throughout the semester, both the instructors and the students gave oral presentations on important global issues. In one exercise, students shared laptop computers to search the internet for climate and weather data that were used to learn basic graphing and statistical techniques.

The strength of this lab course is its diversity and breadth. Every week brought a lab completely different from the proceeding one. Continuity was maintained by using a lab template that contained an introduction, pre-lab resources, objectives, key words, procedures, post-lab questions, and information on calculations and data presentation. Students were also presented with lab report rubrics to ensure that they knew what was expected of them.

In designing the lab module we had to keep in mind that the activities must be rigorous enough to prepare Environmental Science majors for upper level courses. At the same time it could not be forgotten that there are no science or math prerequisites for the lab, and that there would be students for whom this was their only science course. It was important that the material be interesting and relevant so that majors and non-majors alike would be motivated to learn the math and science skills needed to complete the lab, and possibly have a desired awakened to further explore the Earth and its environment in upper level science courses.

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http://esse21.usra.edu/ESSE21/esse21_newmexico.html