Experiential Learning: Engaging the Next Diverse Generation of Scientists

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Abstract

Among the key challenges in science education, low numbers of underrepresented students completing science degrees is a major bottleneck in the development of the US science and technology workforce. The relatively low persistence and retention of African American, Hispanic, and Native American students in undergraduate science programs have a host of negative impacts on issues ranging from the national economy to the conceptualization of advanced degrees and the careers that underrepresented students consider as realistic options. The Rocky Mountain Sustainability and Science Network and the Global Women Scholars Network have responded to this challenge by establishing a summer research academy in the sciences which uses best practices in experiential learning to engage underrepresented students in the sciences. In the past three years, over 100 students have participated in this academy. While over 75% of these students have been underrepresented minorities, 100% have been retained in science and technology related disciplines. This summer research academy is well on its way to becoming a model program for using experiential learning to engage and train the next diverse generation of scientists.

Introduction

The Rocky Mountain Sustainability and Science Network (RMSSN) was established in 2010 under the National Science Foundation's (NSF) Research Coordinated Networks (RCN). It is an existing partnership among 24 universities, federal agencies and other institutions designed to help train the next diverse generation of interdisciplinary leaders who are prepared to address issues related to climate change, environmental sustainability, and the preservation of cultural resources using the Rocky Mountains as a laboratory and classroom. Similarly, the Global

Women Scholars Network was established in 2011 under the NSF-RCN to enhance the training and advancement of women in the sciences. These networks have since partnered to provide a robust collection of multidisciplinary, experiential learning opportunities on public lands specifically designed to enhance global awareness, biological understanding, climate literacy, leadership and communication skills using an experiential learning model. To afford undergraduates who participate in these opportunities with the foundation and framework to more fully appreciate their place-based learning experiences, these networks sponsor a weeklong summer research academy for students prior to their summer internships. This academy is now internationally recognized as the Rocky Mountain Sustainability and Science Summer Academy [1, 2, 3].

The Rocky Mountain Sustainability and Science Summer Academy

Each summer, the Rocky Mountain Sustainability and Science Summer Academy provides multidisciplinary, place-based learning experiences as paid summer internships for approximately 35 students. Prior to those experiences, participants attend the cohort-based, Summer Academy during which they obtain: 1) an introduction to climate literacy; 2) training in biological field protocols relevant to their summer internships; 3) an introduction and practice in communicating in the sciences; 4) training on global leadership in the sciences; 5) problem-based discussions related to environmental sustainability; 6) an introduction to the interdisciplinary nature of collaboration in the environmental sciences; 7) an introduction to the study and preservation of cultural resources on public lands; 8) an introduction to careers related to environmental sustainability, climate change, and preservation of cultural resources; 9) intense group assignments to be completed during the academy and; 10) long-term group assignments to be completed using the RMSSN online networking system throughout the course of the students'

internships. To date, these summer academies have been held at the Shortgrass Steppe Longterm Ecological Research Station adjacent to the Pawnee National Grasslands in eastern Colorado and at the Murie Center situated in Grand Teton National Park near the Moose Visitor Center in Moose, Wyoming. Students who complete the academy, the group assignments, and a report on their summer internship are awarded a Certificate in Global Leadership and Environmental Sustainability from the RMSSN.

The Rocky Mountain Sustainability and Science Summer Research Academy uses public lands as a laboratory of learning for students. Why public lands? Land managers and scientists must work together on the emerging issues related to climate change, environmental sustainability, and preservation of cultural resources which are already evident to stakeholders ranging from the intermountain west of the United States to the dryland ecosystems of Africa. As one example, to understand the complexity of climate-induced changes, we must bridge disciplines and applications so students learn to work in complex ecosystems while also understanding the science driving such complexity. Public lands are particularly well suited for experiential learning in the biological sciences as these outdoor laboratories underscore the large scale effects of human impacts driving global ecological change and can be a vehicle to promote scientific literacy. An additional benefit of public lands as classrooms is the reintroduction of the outdoors for young adults through positive learning experiences and rekindling cultural connections for many minority groups with limited exposure to natural resources. Here, the Rocky Mountain Sustainability and Science Academy becomes an integral player in creating the next generation of resource managers who can help create sustainable public lands resilient to human pressures and climate change.

This program places special emphasis on recruiting underrepresented minorities to the academy and place-based learning opportunities. To date, over 75% of the student participants have been underrepresented minorities. Pre-/Post-assessments from the first three academies were conducted in a quasi-experimental design. This formative assessment indicates that students who participate in the academy prior to entering their internship draw significantly stronger educational outcomes at the conclusion of their internships, relative to students who complete only the internship portion of the experience. A separate assessment comparing a participating versus control group of students whose internships were obtained through the Student Conservation Association indicates that students in the participating group have a higher rate of persistence in the sciences and higher rate of entry into graduate programs / science careers.

Conclusions

Over 100 students have participated in the Rocky Mountain Sustainability and Science Summer Academy. While over 75% of these students have been underrepresented minorities, 100% have been retained in science and technology related disciplines. Our success, to date, has led to the use of our academy as a model for developing and enhancing similar experiential learning programs. Specifically, our model has been used by the Wyoming Conservation Corps at the University of Wyoming and the Center for Sustainability Studies in the School of Environmental and Life Sciences at Kean University. Thus, the Rocky Mountain Sustainability and Science Summer Academy has laid the foundation as a model program for using experiential learning to engage and train the next diverse generation of scientists.

Acknowledgments

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