

RESEARCH INFRASTRUCTURE IMPROVEMENT (RII 4)
PROPOSAL DEVELOPMENT PROCESS

EDUCATION & OUTREACH WHITE PAPER

FOR DISCUSSION
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TITLE: CREATING A STEM INNOVATIVE TEACHING AND
LEARNING CENTER AT NEW MEXICO HIGHLANDS
UNIVERSITY

LEAD AUTHORS: ELIZABETH RATZLAFF (NMHU), EDWARD MARTINEZ
(NMHU)

CONTRIBUTING AUTHORS: N/A

Creating a STEM Innovative Teaching and Learning Center at New Mexico Highlands University

A white paper for development of the New Mexico EPSCoR RII IV proposal

Elizabeth Ratzlaff and Edward A. Martinez New Mexico Highlands University (NMHU)

Description

Many students at New Mexico Highlands University (NMHU) come from school districts where families are struggling with below average incomes and above average poverty rates. Research indicates that high schools with large minority populations tend to have less rigorous science and mathematics curricula (Solorzano, 2004). Forty-four percent of math courses at high-poverty high schools, and over 90% of similar courses at high-poverty middle schools are taught by teachers without certification in math (US Congress, 2006). Thus it is not surprising that many of our students must take additional time and complete developmental courses prior to taking STEM gatekeeper courses such as College Algebra, Calculus, General Chemistry and General Biology.

In an internal report on STEM students at NMHU, the Office of Institutional Effectiveness and Research reports that of 169 entering STEM students based on first-time freshmen cohorts in 2000, 2001, and 2002, only 22 entered with ACT scores that indicated they were “college ready” in math and 15 scored as “college ready” in science (Internal NMHU Report, 2009). Additional challenges are faced by the 39% of NMHU undergraduates who are aged 25 and older. Some of these are students who left school to support their families and lack the resources to return to school as they no longer qualify for state-supported scholarships if they did not enter school immediately after high school or took a semester off.

While many students are academically underprepared, many bring other strengths that are often underutilized in the academic environment. Many rural students have an operational knowledge of physics and engineering and practical skills such as welding, carpentry and mechanics. Unfortunately the link between such practical knowledge and the theories that they are based on are not explicitly discussed and the students never realize the strengths they possess. If STEM disciplines in New Mexico’s institutions of higher education want to increase student learning and consequently increase retention and graduation rates faculty have to work towards recognizing their students’ diverse backgrounds and strengths while increasing interest and engagement through relevant curricula.

In their book “*Talking About Leaving: Why Undergraduates Leave the Sciences*” Seymour and Hewitt (1997) provide overwhelming evidence indicating that many students leave the sciences because they lose interest and are no longer motivated. Tobias (1990) indicates that students are not leaving because they are incapable of the conceptual learning needed to succeed in STEM but because students are not engaged.

A growing literature (for example Fairweather, 2005, AhYun et al., 2005, Tanner 2011, Andrews et al., 2011) indicates that effective teaching and learning strategies exist and are more effective than traditional lecture and discussion formats. These strategies center around student

engagement through both active and collaborative instruction in the classroom as well as experiential learning in the field (Brower and Inkelas, 2007). Although these strategies have the potential to improve student learning, retention, and graduation rates, Andrews et al. (2011) demonstrated that the use of these strategies by a “typical instructor” is not statistically associated with increased learning. Tanner (2011) suggests that in order to better enhance effective teaching and learning, institutions should refocus and develop reflective instructors who are analytical about their practice and are willing to make repeated improvements on their teaching based on evidence from their students and their own experiences (Loucks-Horsley et al., 2003).

Purpose

The purpose of this proposal is to develop a STEM Innovative Teaching and Learning Center at NMHU to provide leadership and training for NMHU STEM faculty and students to integrate interdisciplinary (word missing here?) into STEM education through the inclusion of real-world problem-solving in classroom, design and building activities. The proposed Center builds on the concept that Northern New Mexico offers an opportunity to explore a new direction in teaching while building on both the needs and strengths of some of our rural, competent and skilled but academically underprepared students.

Students and faculty will further their scientific, technological and professional competencies outside the classroom by examining issues, solving problems and offering solutions through field-based research and onsite studies. Working collaboratively with community citizens and professionals in energy, forestry farming, and ranching, students’ will advance their decision-making and communication skills under real-life work situations.

Additional training will emphasize opportunities for faculty to work together to develop a cohesive STEM strategic plan with programs that include assessment of student learning at key points with the goal of integrating results into program improvements and enhancing student success.

Target Audience

NMHU STEM Faculty and Students.

Over 94% of NMHU students come from within the state of NM and the majority (75%) are from the surrounding rural/small town counties of San Miguel, Mora, Rio Arriba, Taos, Colfax, Guadalupe, San Juan, McKinley, and Valencia, which are some of the poorest counties in the State and nation (US Census Bureau, 2009). To meet the needs of its students, NMHU offers affordable four-year and graduate programs (since 1893) to maintain a high Hispanic enrollment. In Fall 2008, over 63% of undergraduates enrolled at NMHU’s main campus were Hispanic and over 62% first-time freshmen were Hispanics.

Relevance to Energy, Water and Environment Nexus

NMHU is situated on the Great Plains where the prairie meets the Rocky Mountains (Santa Fe National Forest). The region consists of rich, but fragile native grasslands, farm and ranch lands, marshes, ponds, timbered canyons and streams. Further, the lands have been used for agriculture by American Indians as early as 5000 BC and expanded to farms and ranches by Hispanics in the

1500s. Both groups struggle to preserve their practices, handle legal issues over land rights and federal funding, and apply modern technology on their land – all of which provide valuable opportunities for research and development of creative solutions to address water, energy and environmental issues.

Through this effort NMHU will increase STEM student retention, graduation, and placement of students in careers in the area of energy, water and environment nexus. These students will become the next generation of leaders and professionals to be proactive in developing our future energy resources through reacting, adapting and problem-solving in an increasing and ever-changing physical, economic, and social environment.

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