New Mexico: Making a World of Difference! Integrating Research, Education and Outreach











Dr. Laura J. Crossey Keynote Address

Faculty Leadership Program-January Workshop 2010

Overview

- Diversity, training and Outreach- a STEM obligation & and an EPSCoR obligation
- 'Pipeline' Issues: Example- NM Landscape
- View from the Ivory Tower (or 'What's in it for ME?!')
- NSF Programs: Overarching Efforts ISE, CCLI, IGERT, GK-12, NM AMP, ADVANCE/Examples
- Focus on REU and partnerships

EPSCoR Mission Statement: Diversity

"NM has the highest percentage of people of Hispanic ancestry of any state (44%) as well as a large Native American population (9%). With its minority-as-majority population, NM has a unique opportunity and special responsibility to lead the nation in addressing the shortage in its S&T workforce by educating a new generation of STEM professionals more representative of the nation's growing minority population. At the same time, NM can develop a stronger STEM workforce and citizenry informed about climate change and its impact on natural resources and economic development." NM EPSCoR Website

Example: UNM



2010- New Mexico IS the Face of the Future



The student population of the U.S. is projected to be 50% underrepresented minorities by 2050. The current UNM enrollment demographic is similar to the projected distribution of the U.S. student population projected for ~2045.

Opportunity: NM Impact!

National data demonstrate that STFM degrees awarded to underrepresented groups lags behind enrollment trends. UNM's Life Sciences BS is at parity with enrollment at 47%, but needs to improve at the graduate level. Other STEM disciplines need to improve at all levels



UNM Biol BS

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Think about it- What is YOUR mission?

CATEGORIES FOR FACULTY PERFORMANCE EVALUATIONS The traditional categories in which faculty performance is evaluated are the following:

- (1) Teaching
- (2) Scholarly Work
- (3) Service
- (4) Personal Characteristics

By any measure, mentoring and student training consume faculty resources... time AND money. How does mentoring play a role in this (including udergraduates, graduates, post-docs, junior faculty)? Can enhancing diversity and student training affect category (2) in a positive way for early-career faculty?

Perspectives from a Professor/Researcher Engagements beyond the Ivory Tower

- Balance Teaching, Research & Service Missions
- Integrate Research with Teaching, Mentoring and Service!
- Find the resources (\$) wherever you can
- Find Partners and Leverage Effort and Resources

NSF Opportunities: Education and Human Resources (EHR)



Division of Graduate Education: DGE

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Div. Of Undergraduate Education (DUE)

DUE's current programs constitute a comprehensive approach to strengthening STEM education at two- and four-year colleges and universities by improving curricula, instruction, laboratories, infrastructure,

assessment, diversity of students and faculty, and collaborations.



Research on Learning: Formal/Informal



HRD includes RUI and REU site-based programs.



Human Resource Development (HRD)

The Trail of Time at Grand Canyon: Using Teachable Moments

Laura J. Crossey & Karl Karlstrom University of New Mexico \$2.3 M over 4 years





The World's Largest Geoscience Exhibition at the World's Grandest Geologic Landscape



Location Location Location! Prime Real Estate- The Rim Trail– Estimated 5 million visitors each year





An NSF-funded ISE (Informal Science Education) Program (\$2.3M for 2006-2010) to K. Karlstrom & L. Crossey, UNM

Elements of the Trail of Time- Main Trail



The heart of the Trail of Time is a set of bronze time markings:
 small markings every meter (one for each million years) and labeled time markings every tenth meter- 2,000 markers!
 You'll always know "when" you are along the timeline



Grand Opening targetted for October 2010

Indigenous Geoscience Education – links to an indigenous knowledge base and need

- 1) place –based
- 2) culturally responsive
- 3) direct involvement of Navajo, Hopi, Hualapai, Havasupai, & Piute peoples





Ted UNM AMP URA 2006 Petroleum Engineer, TX



Hualapai River Runners... future students?

Karlstrom and Crossey run Geoscience training trip for the Hualapai River Runners

Charles Resource Technician Hualapai Link the NSF-supported university researchers...



... to the 5 million visitors!

... to the National Park Service...

Wow- does the Park let ANYONE drill?





A sustained research effort:

Karlstrom and Crossey have over 20 years of continuous NSF funding for basic research on Grand Ganyon geology – 100's of publications and presentations

Using University Opportunities: Integrating Research, Education and Recruitment!!







Crossey's Freshman Learning Community Intro Geo class, Fall 2009 at Grand Canyon. 25 Freshmen, high diversity (Co-taught w/ K. Karlstrom).



COHYDROGEOLOGY IN THE MIDDLE RIO GRANDE ENVIRONMENT

E-MRGE: An NSF-funded GK-12 Program (\$1.7M for 2006-2009)

Dr. Laura J. Crossey, Earth & Planetary Sciences and Dr. Scott Collins, Biology



Graduate Teaching Fellows in K-12 Education (GK-12) Program

Program Benefits to date

- 23 Fellows impacting 15 middle school teachers and at least 120 classrooms (~3600 students) in three communities over past four years
- Community events and visibility (for STEM, for NM, for UNM)
- One Fellow/teacher pair nationally recognized by NSF for exemplary practice (Theresa Apodaca of Sarracino MS Socorro, also awarded NM Outstanding Science Teacher in 2009).
- 'Place-based' curricula disseminated
- Hundreds of students participating in extra field trips and summer STEM activities
- Teachers from underserved communities in communication with STEM faculty/resources

Program Elements

- Fellow recruitment (~50:50 EPS/Bio, M/F, mainly PhD)
- The 'Match' (Fellow/Teacher pairings)
- Weekly on-campus seminars for Fellows (pedagogy, technology, evaluation/assessment)
- 10 hrs/week in schools for partners
- Special inter-school events/field trips
- Summer Field Internships for students
- Dissemination/publication (GSA, ESA, NSTA, NAGT...)
- Program Evaluation (ISR: work logs, observation, surveys)

ECOHYDROGEOLOGY IN THE MIDDLE RIO GRANDE ENVIRONMENT

Graduate Teaching Fellows in K-12 Education (GK-12) Program

Place-based, Hands on, Minds on!

Graduate Teaching Fellows in K-12 Education (GK-12) Program

NM AMP and the Pipeline to MS/PhD

Bridge to the Doctorate (LSAMP)

AMP BD Cohort VI Fellows and Director L. Crossey at the Annual JAM, Washington DC

2009 JOINT ANNUAL MEETING Innovation and Leadership through a Diverse STEM Workforce

June 8-11, 2009 | Omni Shoreham Hotel, Washington, DC National Science Foundation

Division of Human Resource Development Directorate for Education and Human Resources

Co-sponsored by Directorate for Biological Sciences (BIO)

We can succeed with our partnerships

REU/RUI

- For students in STEM fields research is an important part of the educational process
- Most undergraduate programs have some mechanism for undergraduate research
 - Senior thesis or capstone projects (credit)
 - Independent study (credit)
 - Research for pay

Rationale

- What can we do to go beyond the usual providing the usual undergraduate research experience?
 - More intensive and innovative experiences
 - Integrate research and undergraduate teaching
 - Reach underrepresented and non-traditional students
 - Reach students at other universities
 - □ How to pay for such activities (time AND \$\$)?

RUI

- NSF Research at Undergraduate Institutions (RUI)
 - Funds research by faculty at predominantly undergraduate institutions
 - Seeks to promote the integration of research and education
 - □ Typically, \$10K to \$100K
 - Supports:
 - individual and collaborative research projects
 - the purchase of shared-use research instrumentation
 - Research Opportunity Awards (ROAs) for work with NSF-supported investigators at other institutions

REU

- NSF Research Experiences for Undergraduates (REU)
- NSF-wide, proposals for REU programs accepted in all disciplines
- Two types
 - REU Sites initiate and conduct independent projects that engage undergraduates in research (generally summer)
 - REU Supplements an add-on for ongoing NSF-funded research projects
 - Large program \$57 million in 2008, 150 sites and 1,600 supplements per year
- "The REU program is a major contributor to the NSF goal of developing a diverse, internationally competitive, and globallyengaged science and engineering workforce."

Approaches that Work

- Find moments that matter to studentsactive inquiry approaches in introductory classes, undergraduate research experiences
- Find the resources (\$) wherever you can
- Nurture the motivated students
- Work the whole pipeline from preK to post Doc and teachers/families
- Integrate programs and partners
- Early-career focus: synergy with research and mentoring