

### Summary

In August 2010, a diversity-focused Innovation Working Group (IWG) met in Jemez Springs, NM to develop *The New Mexico STEM Higher Education Diversity Network*. The intended purpose of this network was to identify and begin solving problems that lead to the underrepresentation of minority racial and cultural groups in Science, Technology, Engineering, and Mathematics (STEM) higher education fields in New Mexico. Most of the two and four year colleges in New Mexico were represented at the meeting. This three-day meeting achieved a number of important goals, including the identification of a number of key problems that lead to underrepresentation and the development, strategies for addressing these problems, and submission of a Science Talent Expansion Program (STEP) proposal to the National Science Foundation (NSF) based on these strategies.

### Background

Minority racial and cultural groups are underrepresented at the undergraduate, graduate, and professoriate levels in New Mexico colleges and universities. This situation exists despite the presence of large minority populations within the state. New Mexico is currently ~45% Hispanic and ~5% Native American. However, these groups are underrepresented in higher education relative to population levels within the state. This situation is especially acute at New Mexico's Ph.D.-granting universities at the graduate and professoriate levels and in science, technology, engineering, and mathematics (STEM) related fields generally. In addition to being underrepresented, minority students are less likely to complete their degree programs (especially in STEM fields).

These problems are not unique to New Mexico. Nationwide, the relatively poor success of students in completing undergraduate degree programs in STEM fields is well documented (Seymour and Hewitt, 1997). Additionally, the fact that underrepresented minority (URM) and female students are even less likely to complete STEM degrees as their white, Asian, and male peers is well known (Seymour and Hewitt, 1997). While almost one half of all students earning B.S. and M.S. degrees in STEM fields start their academic careers at a community college (Tsapogas, 2004), graduation rates from these colleges are low (~30%) and the matriculation rate from 2-year to 4-year colleges (~20%) and STEM graduation rates are even lower (Lloyd and Eckhardt, 2010).

Poor preparation in the K-12 setting is one reason often blamed for the poor success rates of STEM majors in obtaining degrees. Indeed, New Mexico serves as a worst-case example of this problem (Winograd *et al.*, 2010). ~40% of public high school students entering New Mexico public institutions of higher education take remedial mathematics and ~50% take either remedial mathematics or reading. Furthermore, Native Americans are twice as likely to take remedial courses as Caucasians and Hispanics and African-Americans are ~1.5 times as likely. This poor preparation has a marked effect on graduation rates. New Mexico students who need remedial work are almost half as likely to earn a degree or certificate, compared to those not needing remedial work. Additionally, the more remedial classes required, the less likely the student is to graduate. In the 2003 cohort, students needing 3 remedial classes only graduated college at a rate of 4% and only earned a bachelor's degree at a rate of 1.3%.

While preparation is clearly a problem in New Mexico, other factors probably also affect STEM graduation rates, especially among capable students choosing between STEM and non-STEM degrees. In their study, *Talking About Leaving: Why Undergraduates Leave the Sciences*, Seymour and Hewitt document a pervasive dissatisfaction among all STEM majors with the culture of STEM instruction and mentoring in colleges of all types (2007). This is especially true of female and minority students. In case after case they examined, students struggling in just one class were told to leave their STEM major. Seymour and Hewitt also found that students typically view entry level classes as being designed to "weed out" unsuitable majors, instead of as important groundwork for future classes. Clearly, a change in how STEM majors are mentored is needed.

A variety of programs designed to remedy these problems exist at a number of New Mexico colleges and universities. These efforts include retention and recruitment programs, undergraduate summer research programs, programs to bring minority high school students to universities, and graduate student scholarship programs. However, these efforts to increase underrepresented minority (URM) populations in STEM higher education fields are largely uncoordinated, with no way to track students as they move up the academic ladder. Programs also sometimes work at cross-purposes. Some examples are programs to assist incoming freshman, but do not provide similar support and programming for Native American students who enter as juniors after receiving an A.S. degree at a tribal or community college. Additionally, summer undergraduate research programs often compete for the same students instead of collaborating to match students to programs for greater success. Finally, most programs are designed for strong students, rather than addressing their participants' levels of maturity and academic progress so that students can transition from program to program more successfully. A mechanism is needed to encourage or help students to move from one program to another as they progress in their academic careers. Finally, too few of these efforts exist within the state.

### IWG Goals

The goals of the IWG were to:

1. study the current state of STEM higher education diversity programs and efforts in New Mexico,
2. develop a mission for the IWG that drives future work by the committee,
3. examine the ongoing assessment efforts with regards to diversity and plan for any needed future assessment mechanisms,
4. consider how existing programs could be improved,
5. identify gaps in diversity programs and plan grant writing for new programs that fill those gaps,
6. develop a plan for a statewide higher education diversity pipeline and plan grant writing to implement that plan,
7. and create an ongoing IWG that meets regularly, in person and through cyberspace.

### Meeting Agenda

#### Friday, August 20

9:00 AM to 12:00 PM      Participants arrived in Jemez Springs, Check in

12:00 PM                      Lunch and introductions

1:00 PM                      Opening remarks, review of agenda

#### *Session 1 – The State of Diversity in STEM Higher Education in New Mexico*

In this session, representatives from each campus presented their institution's statistics on diversity in STEM fields and described the current efforts on that campus to recruit, retain, and serve underrepresented minority students.

1:30 PM                      Michael Pullin – New Mexico Tech

1:50 PM                      Edward Martinez – New Mexico Highlands University

2:10 PM                      Phyllis Baca – Santa Fe Community College

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2:30 PM	Camilla Bustamante – Northern New Mexico College
2:50 PM	Marnie Carroll - Diné College
3:10 PM	Break
3:30 PM	John Montgomery – Eastern New Mexico University
3:50 PM	Laura Crossey – University of New Mexico
4:10 PM	Tres Camacho – Western New Mexico University

The presentations were followed by discussion of the problems facing each campus in increasing and serving diversity.

6:00 PM          Dinner

### Saturday, August 21

8:00 AM          Breakfast

#### *Session 2 – Mission Statement*

In this session, we will develop a mission and a set of goals for the IWG.

9:00 AM	Breakout groups – Brainstorm IWG Goals and a one sentence mission statement
10:00 AM	Break
10:15 AM	Discussion and Finalization of the network mission

#### *Session 3 – Assessment*

This session focused on assessing our efforts and tracking students.

10:45 AM	Stephany Moore, New Mexico Tech – Assessing diversity statewide and tracking students
11:15 AM	Questions and Discussion
12:00 PM	Lunch and afternoon break

#### *Session 4 – New Program/Proposal Efforts*

This session focused on the discussion and planning of a grant proposal to the NSF STEP program.

3:00-5:00 PM      Breakout groups

5:00 PM	Discussion
6:00 PM	Dinner
7:30 PM	Further discussion and finalization of grant writing plan

**Sunday, August 22**

8:00 AM	Breakfast and room checkout
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*Session 6 - Planning for the future*

What next? How will we keep the momentum going? When will our next meeting be held? How will it be funded?

9:00 AM	Recap of the session
9:15 AM	Writing assignments, timeline, and identification of institutional data needed for the proposal
11:15 AM	Closing comments
11:30 AM	Lunch and departure

**List of Attendees**

Michael Pullin – New Mexico Tech

Lisa Majkowski – New Mexico Tech

Marnie Carroll – Diné College

Edward Martinez – New Mexico Highlands University

John Montgomery – Eastern New Mexico University

Tres Camacho – Western New Mexico University

Phyllis Baca – Santa Fe Community College

Camilla Bustamante – Northern New Mexico College

Laura Crossey – University of New Mexico

Mary Jo Daniels – New Mexico EPSCoR

Stephany Moore – New Mexico Tech

## **Accomplishments**

### **Mission and Focus**

The IWG initially focused its discussion on: Who is a STEM student? The IWG concluded that its work would focus on:

- The general focus of our efforts will be on traditional and some emerging science and engineering disciplines
- STEM majors
  - Biology and Chemistry
  - Physics and Math
  - Earth and Environmental Sciences
  - All types of A.S. and B.S. engineering degrees
  - Computer science students are included, but some information technology students may not be
  - Environmental resource management students are included
- Students taking STEM classes
  - Potential majors!
  - Pre-professional students (nursing, etc) will be included
- Applied technology students may be included
  - Included if they are able to transfer to STEM program
  - Efforts must address the issue of multiple entry and exit points from STEM programs
  - Will depend on the program
- Social science students (psych, anthropology, etc) not included

### **Strategies**

Several breakout sessions and whole-group discussions identified the following strategies for increasing the number and diversity of STEM students in New Mexico:

1. Bridging transitions – recruitment and retention
  - a. K-12 to college
  - b. Entry of nontraditional students into college
  - c. 2-year to 4-year institutions
  - d. Transfer students
  - e. 4-year to graduate programs
2. Faculty development
  - a. Increased recruitment and retention of URM faculty
  - b. Training of faculty to understand diverse audiences and issues facing first generation college students
  - c. Improved advisement and college success courses
3. The integration of traditional knowledge into the classroom and research laboratory
  - a. Recruitment and retention of URM students
  - b. Increased faculty excitement about working on Native/Traditional lands and working with URM students
  - c. Students reporting back to the community
4. Statewide tracking of URM students across educational levels

5. How to best serve geographically limited students?
  - a. Increased distance education
  - b. Allow multi-institution classes
  - c. Explore the concept of the multi-institution degrees
6. Improve math course success
7. Asset mapping statewide
8. Academic program issues
  - a. Recruitment to STEM programs
  - b. Completion of STEM degrees
  - c. Analysis of time to graduate
  - d. Institutional barriers to completion
  - e. Scheduling
9. Work with Council of University Presidents

### **The NSF STEP Proposal**

Once the mission of the IWG and operational strategies were identified, discussion quickly moved to planning for the submission of a collaborative proposal to the NSF's Science Talent Expansion Program (STEP). The IWG decided to develop a submission that proposed three areas of focus: 1.) improving math skills and readiness of incoming and early-year students, 2.) improving peer-tutoring and student mentoring for early-year STEM students, and 3.) the development of a transfer student transition program.

The committee agreed that improving the math skills of incoming and beginning-level A.S. and B.S.-degree seeking students would be an effective strategy to improve the retention of these students in college and in STEM majors. This goal would be reached by implementing a state-wide "math camp" system, where various colleges would offer a summer program that would focus on improving students math skills and advance them in their math sequence. The math camps would use a non-traditional approach to teaching mathematics, focused on using environmental data as examples of math applications. We also agreed that increased resources for peer mentoring were much needed. Finally, we agreed that a program that looked after students when they transferred from 2-year to 4-year colleges was much needed.

The IWG participants agreed on a plan of action and gave individuals writing assignments and identified institutional data for each campus to collect prior to the proposal deadline of September 27, 2011.

The STEP proposal was completed and submitted to the NSF. The project summary for the submitted proposal is given below:

### **Project Summary**

This collaborative proposal describes the formation of the *New Mexico STEM Pathway Program*. This program aims to increase the graduation rates of STEM students at nine New Mexico public institutions of higher education by 150 graduates over five year. The program will serve 500 students during the funding cycle will be institutionalized at the end of the program. All of the institutions involved in this program serve large numbers of underrepresented minority students, mainly Hispanic, Latino, and Native American students. The collaboration includes two research universities, three regional, masters level institutions, three community colleges, and Diné College, the 2-year tribal college of the Navajo Nation.

The programs proposed here will focus on three areas, improving math skills and readiness of incoming and early-year students, improving peer-tutoring and student mentoring for early year STEM students, and the development of a transfer student transition program. The math effort will use an innovative and well-tested curriculum ("Earth

Math”) that uses environmental problems such as global climate change as the basis for teaching mathematics. This curriculum will be adapted for our program and used in residential, intensive summer math courses (“math camps”) to increase the incoming math placement of students at the four-year colleges by one or two classes. Intensive non-residential summer courses will achieve the same goal in the community college setting. Navajo culture-focused math camps will also be held at Diné College. Participants in the math camps will be enrolled in a college success course aimed at STEM majors during the next academic year and provided with peer tutoring for gateway, high failure rate math and science courses, organized mentoring, and professional development. Students matriculating from 2-year to 4-year institutions will participate in a transfer student transition program. This program will use a cohort approach, peer tutoring, organized mentoring, and professional development to support students during the first year of their transition.

Participants in these programs will also be integrated into a long standing and highly successful NSF AMP program in New Mexico. They will also be encouraged to take advantage of other statewide and local program, such as summer research opportunities and S-STEM scholarship programs. This effort will form an organized “pathway” program and support network for STEM students at these nine campuses. These students will be tracked state-wide.

*Intellectual Merit* – The proposed math curriculum uses a well tested curriculum shown to be successful at increasing math skills. The curriculum has also been shown to improve general problem solving skills, giving added benefit to STEM majors beyond a more typical presentation of mathematics. Additionally, the use of an “intensive” approach in difficult courses has been shown to be successful at increasing student success. This proposal will test these concepts further using a well-designed assessment plan and make public its findings. The programs proposed here have strong administrative support and will be institutionalized if they are successful.

*Broader Impacts* – This program will build on existing STEM-support programs within the state to create a state-wide STEM pathway program. This proposal develops collaborations among nine institutions of higher education in New Mexico. Institutionalization will increase the capacity of these institutions to successfully provide well-trained scientists and engineers to society. A proposed collaboration with a New Mexico EPSCoR-funded research project to study the effects of climate change on water resources in the state will help bridge the gap between research and education. Additionally, since all of the institutions involved serve significant underrepresented populations, the program will increase diversity in STEM fields.

The complete, submitted proposal is available upon request from the IWG organizers.

### Conclusions

This IWG was highly successful. We recruited and attracted a diverse audience of faculty and administrators from 8 different minority serving institutions (including one tribal college) in New Mexico. The IWG identified some specific and novel areas to focus on in regards to improving minority student success in the state. The meeting led to the development and submission of an inter-institutional proposal to the NSF.