Becoming Institutional Change Agents in STEM
Alicia C. Dowd, Associate Professor & Co-Director
NSF STEP Grantees Meeting
Washington, D.C. March 17, 2011
Preparing the Next Generation of STEM Innovators: Identifying and Developing Our Nation’s Human Capital
EXPANDING UNDERREPRESENTED MINORITY PARTICIPATION

America's Science and Technology Talent at the Crossroads

UR Minorities in US Pop = 28.5%

UR Minorities in US S&E = 9.1%

Excerpted from *Talent at the Crossroads*
Women and underrepresented minorities as a percentage of full-time, full professors with science and engineering doctorates: 1979–2008

Women, Minorities, and Persons with Disabilities in Science and Engineering: 2011
www.nsf.gov/statistics/wmpd/
Employed Hispanics 16 years and older as a percentage of selected occupations: 2009

Women, Minorities, and Persons with Disabilities in Science and Engineering: 2011
www.nsf.gov/statistics/wmpd/
RISING ABOVE THE GATHERING STORM

Energizing and Employing America for a Brighter Economic Future

NATIONAL ACADEMY OF SCIENCES, NATIONAL ACADEMY OF ENGINEERING, AND INSTITUTE OF MEDICINE OF THE NATIONAL ACADEMIES
Preparing the Next Generation of STEM Innovators

Keystone Recommendations:

I. Provide opportunities for excellence

II. Cast a wide net

III. Foster a supportive ecosystem
II. Policy Actions: *Cast a Wide Net*

- Improve talent assessment systems
- Preparation in STEM talent identification for teachers, principals, and counselors
- Improve identification of overlooked abilities
III. Policy Actions:  
*Foster a Supportive Ecosystem*

- Campaign to appreciate academic excellence
- Professional development for educators in STEM pedagogy
- Professional development for principals and counselors to develop leadership skills
- Conference to explore best practices
A Social Scientist’s Dilemma

How do individuals become motivated to change practices and policies in which they are embedded, which may be invisible to them? To become a “change agent”? 
Case Studies with Mixed Method
Rich Case Sampling of “Exemplars”

I. Multiple Regression: Prediction of “Overperformers”
II. Web Site Review: Institutional Support?
III. Interviews and Observations at potential exemplary institutions
   • 6 HSIs (3 four-year universities and their feeder community college)
   • 100 faculty, administrator, and staff interviews
Collaborating Researchers

• Estela Mara Bensimon, USC Professor and CUE Co-Director, Co-PI
• Ricardo Stanton Salazar, USC Associate Professor
• Lindsey Malcom, UCRiverside Assistant Professor
• Roseanne Macias
• Brianne Davila
• Linda Taing Shieh
The Center for Urban Education (CUE) conducts socially conscious research and develops tools needed for institutions of higher education to produce equity in student outcomes.
Theoretical Approaches

• Sociology
• Action Research/Action Science
• Practice Theory
• Organizational Learning
• Critical Theory
• Psychology

- High-status
- Non-kin individuals
- Provide key forms of social and institutional support
- Negotiate institutional support, in the form of highly valued resources, opportunities, privileges, and services
- *Have a critical consciousness*
Institutional Agent Role Types

- Knowledge Agent
- Advisor
- Advocate
- Networking Coach
- Integrative Agent
- Cultural Guide
- Program Developer
- Lobbyist
- Political Advocate
- Recruiter
- Bridging Agent
- Institutional Broker
- Coordinator
# Types of Institutional Support

<table>
<thead>
<tr>
<th>Direct Support</th>
<th>Integrative Support</th>
<th>Systems Developer</th>
<th>System Linkage &amp; Networking Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Agent</td>
<td>Integrative Agent</td>
<td>Program Developer</td>
<td>Recruiter</td>
</tr>
<tr>
<td>Advisor</td>
<td>Cultural Guide</td>
<td>Lobbyist</td>
<td>Bridging Agent</td>
</tr>
<tr>
<td>Advocate</td>
<td></td>
<td>Political Advocate</td>
<td>Institutional Broker</td>
</tr>
<tr>
<td>Networking Coach</td>
<td></td>
<td></td>
<td>Coordinator</td>
</tr>
</tbody>
</table>

Professor Manuel Diaz

- Professor of Bio-Chemistry
- Teaches at a four-year Hispanic Serving Institution
- Mexican American Male
- Taught at university for over 15 years

- Read the Manuel Diaz Profile in CUE’s STEM Toolkit: Tools for Increasing Latina and Latino STEM Baccalaureates

- http://cue.usc.edu/tools/stem_focus.html
Manuel Diaz – an Institutional Agent

What Institutional Agent roles does Professor Diaz take on with his students?

• Bridging Agent
• Cultural Guide
• Networking Coach
• Advocate
• Integrative Agent
Professor Luis Martinez – Program Developer

• Chemistry Professor & Dean of Diversity Initiatives at a four-year university
• Develops programs
• Advocates for systemic change
• Reinterprets selection criteria
• Changes the rules
• Sees and develops talent
• Creates networks
Professor Brian Breslaw – Lobbyist

• Engineering Professor at a community college
• Lobbies his Dean for resources to establish a partnership between their college and the medical school at the local four-year university to introduce his Latino engineering students to bio-medical engineering
Institutional Agents in Action – Sarah Gardner

- Program Director of a federally funded STEM Program for underserved students
- Works at a four-year university
- White Female
- Has been working at university for 5 years
How does Sarah Gardner Take on the Following Institutional Agent roles?

- *Knowledge Agent*
- *Advisor*
- *Advocate*
- *Coordinator*
Institutional Agent Role Types

**Direct Support**
- **Resource Agent**
  - provides personal and positional resources to students
- **Knowledge Agent**
  - knows “the system”
  - accesses or provides knowledge pertinent to navigating the system
- **Advisor**
  - helps students gather information
  - assesses problems and possible solutions in a collaborative manner
  - promotes & guides effective decision making
- **Advocate**
  - promotes and protects the interests of “their” students
- **Networking Coach**
  - teaches students how to network with key institutional agents
  - models appropriate networking behavior
  - develops relationships with important and influential people

**Integrative Support**
- **Integrative Agent**
  - coordinates students’ integration and participation in networks and professional venues (professional associations, department, school, etc.)
- **Cultural Guide**
  - guides students through new social situations in a particular cultural sphere
  - teaches students to identify and interact with key people in cultural sphere

**System Linkage & Networking Support**
- **Recruiter**
  - actively recruits students into program, department, etc.
- **Bridging Agent**
  - introduces students to institutional agents
  - has a strong social network
  - knows what key players do
- **Institutional Broker**
  - negotiates introductions and agreements between two or more parties
  - knows what resources are available and who controls or possesses them
- **Coordinator**
  - assesses student’s needs
  - identifies resources to address need
  - provides or accesses institutional resources on behalf of students
  - ensures students utilize resources
- **Program Developer**
  - develops program that embeds students in a system of agents, resources, and opportunities
- **Lobbyist**
  - lobbies for organizational resources to be directed toward recruiting and supporting
- **Political Advocate**
  - joins political action group that advocates for social policies and institutional resources that would benefit targeted groups of students

Three Life Tasks...Require Different Forms of Knowledge

“Theorizing” requires Epistemic Knowledge
Three Life Tasks...Require Different Forms of Knowledge

“Building” requires Techne Knowledge
Three Life Tasks...Require Different Forms of Knowledge

“Praxis”
(Doing the Good)
Requires Phronetic Knowledge
(Phronesis/Practical Wisdom)
Science and engineering bachelor’s degrees earned by underrepresented minorities, by field:

NOTE: Data not available for 1999.

Women, Minorities, and Persons with Disabilities in Science and Engineering, 2011
www.nsf.gov/statistics/wmpd/
Bachelor's Degrees Awarded to Hispanics in Science & Engineering and Non-Science & Engineering Fields, 2000-2008

![Graph showing the trend of bachelor's degrees awarded to Hispanics in science & engineering (S&E) and non-science & engineering (Non S&E) fields from 2000 to 2008.](image)

Bachelor’s Degrees Awarded to Hispanics in Science and Engineering Fields, 2000-2008

<table>
<thead>
<tr>
<th>Field</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Sciences</td>
<td>8,936</td>
<td>8,966</td>
<td>9,628</td>
<td>10,580</td>
<td>11,244</td>
<td>12,358</td>
<td>12,786</td>
<td>13,766</td>
<td>14,605</td>
</tr>
<tr>
<td>Psychology</td>
<td>6,127</td>
<td>6,178</td>
<td>6,695</td>
<td>6,828</td>
<td>7,285</td>
<td>7,708</td>
<td>8,236</td>
<td>8,506</td>
<td>8,885</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>4,446</td>
<td>4,547</td>
<td>4,367</td>
<td>4,840</td>
<td>4,611</td>
<td>4,819</td>
<td>5,084</td>
<td>5,453</td>
<td>5,995</td>
</tr>
<tr>
<td>Engineering</td>
<td>4,075</td>
<td>4,015</td>
<td>4,136</td>
<td>4,358</td>
<td>4,483</td>
<td>4,628</td>
<td>4,928</td>
<td>4,962</td>
<td>5,234</td>
</tr>
<tr>
<td>Computer Sciences</td>
<td>2,154</td>
<td>2,396</td>
<td>2,776</td>
<td>3,590</td>
<td>3,758</td>
<td>3,529</td>
<td>3,351</td>
<td>2,970</td>
<td>2,923</td>
</tr>
<tr>
<td>Mathematics &amp; Statistics</td>
<td>599</td>
<td>625</td>
<td>672</td>
<td>671</td>
<td>678</td>
<td>821</td>
<td>881</td>
<td>946</td>
<td>924</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>883</td>
<td>870</td>
<td>863</td>
<td>861</td>
<td>885</td>
<td>938</td>
<td>989</td>
<td>1,032</td>
<td>1,122</td>
</tr>
<tr>
<td>Earth, Atmospheric, &amp; Ocean Sciences</td>
<td>125</td>
<td>157</td>
<td>136</td>
<td>119</td>
<td>131</td>
<td>151</td>
<td>143</td>
<td>135</td>
<td>192</td>
</tr>
</tbody>
</table>

Enrollment in Undergraduate Engineering Programs, 1998-2008

Enrollment in Undergraduate Engineering Programs, 1998-2008

Degrees Awarded to Hispanics in Science and Engineering Fields, 2000-2008

Science and Engineering Doctoral Degrees Awarded By Ethnicity and Citizenship, 2000-2008

<table>
<thead>
<tr>
<th>Year</th>
<th>Hispanic</th>
<th>All other US Citizens</th>
<th>Temporary Resident</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>719</td>
<td>16,727</td>
<td>7,977</td>
</tr>
<tr>
<td>2001</td>
<td>815</td>
<td>16,466</td>
<td>8,192</td>
</tr>
<tr>
<td>2002</td>
<td>758</td>
<td>15,556</td>
<td>7,940</td>
</tr>
<tr>
<td>2003</td>
<td>784</td>
<td>16,071</td>
<td>8,570</td>
</tr>
<tr>
<td>2004</td>
<td>916</td>
<td>16,355</td>
<td>9,302</td>
</tr>
<tr>
<td>2005</td>
<td>973</td>
<td>16,856</td>
<td>10,732</td>
</tr>
<tr>
<td>2006</td>
<td>1,003</td>
<td>17,397</td>
<td>12,052</td>
</tr>
<tr>
<td>2007</td>
<td>1,071</td>
<td>18,524</td>
<td>12,993</td>
</tr>
<tr>
<td>2008</td>
<td>1,162</td>
<td>19,022</td>
<td>13,173</td>
</tr>
</tbody>
</table>

A Tool for Equity in STEM: Math Syllabi Review

TO CALCULATE YOUR COURSE AVERAGE:
CA = 0.1x HW + 0.1x(E1+E2+E3+E4+E5+E6)+0.2xFE
Contact Information
Center for Urban Education, USC
alicia.dowd@usc.edu
(213) 740-5202
http://cue.usc.edu

Suggested Citation:
PowerPoint presentation. NSF STEP Grantees Meeting.

Center for Urban Education © 2011 All rights reserved.
University of Southern California