The Persistence of Women of Color in STEM Fields: What Research Tells Us

Lorelle L. Espinosa, Ph.D.
Director of Policy and Strategic Initiatives

Quality Education for Minorities Network, Women Faculty in STEM at HSIs
July 30, 2010

PRESENTED BY
The Institute for Higher Education Policy

Presentation Outline

I. Why women of color faculty in STEM?

II. The STEM Landscape for women and women of color

III. *Inside the Double Bind* Project

Why Women of Color Faculty in STEM?

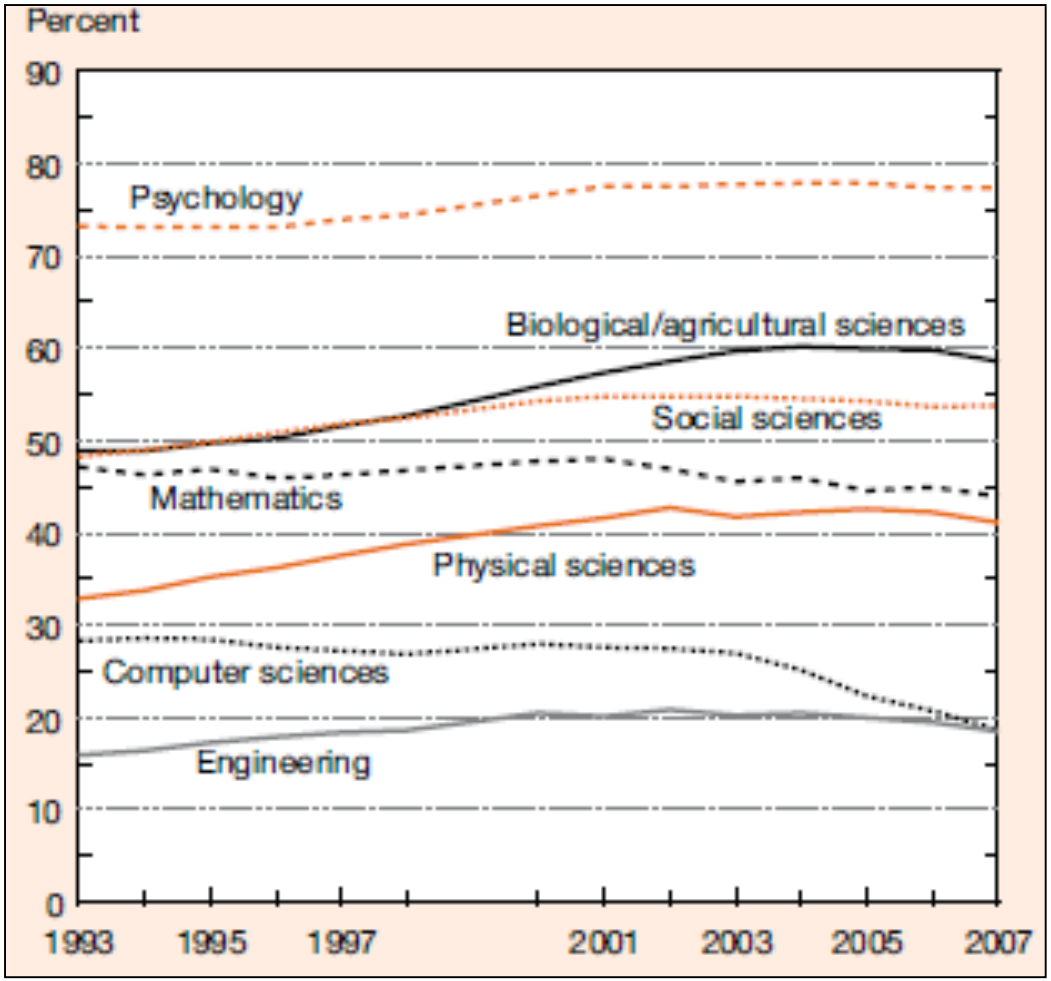
- National scientific and technological innovation = we must invest in the talent of all U.S. citizens
- Diverse perspectives and pedagogies in the STEM classroom and laboratory
- Educational benefits of learning from diverse faculty
- Importance of mentors and role models in STEM education
- Hispanic women in STEM are still behind their male peers, particularly in physics, engineering, computer science

IHEP

The STEM Landscape for Women and Women of Color

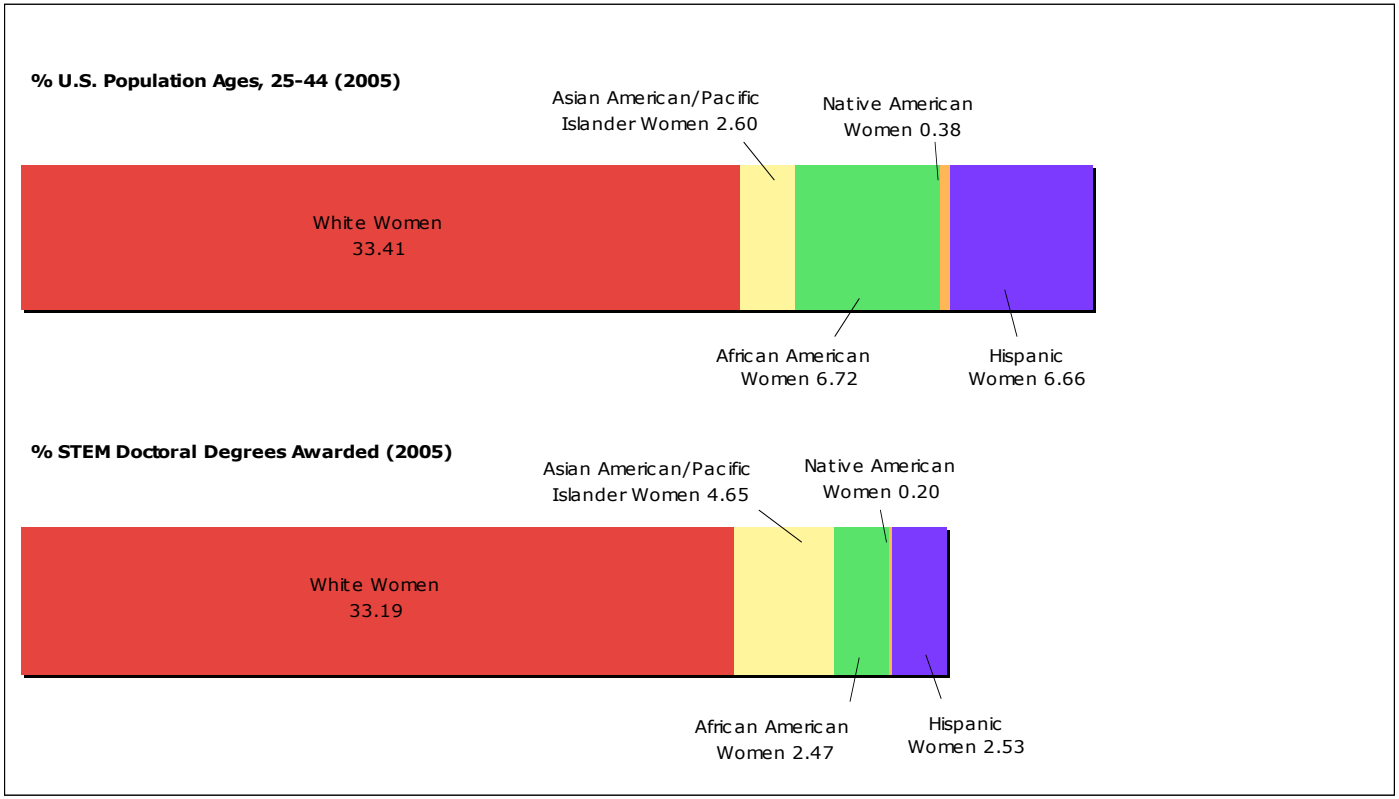
PRESENTED BY
The Institute for Higher Education Policy

Percentage of B.S. Degrees Granted to Women by Field 1993-2007



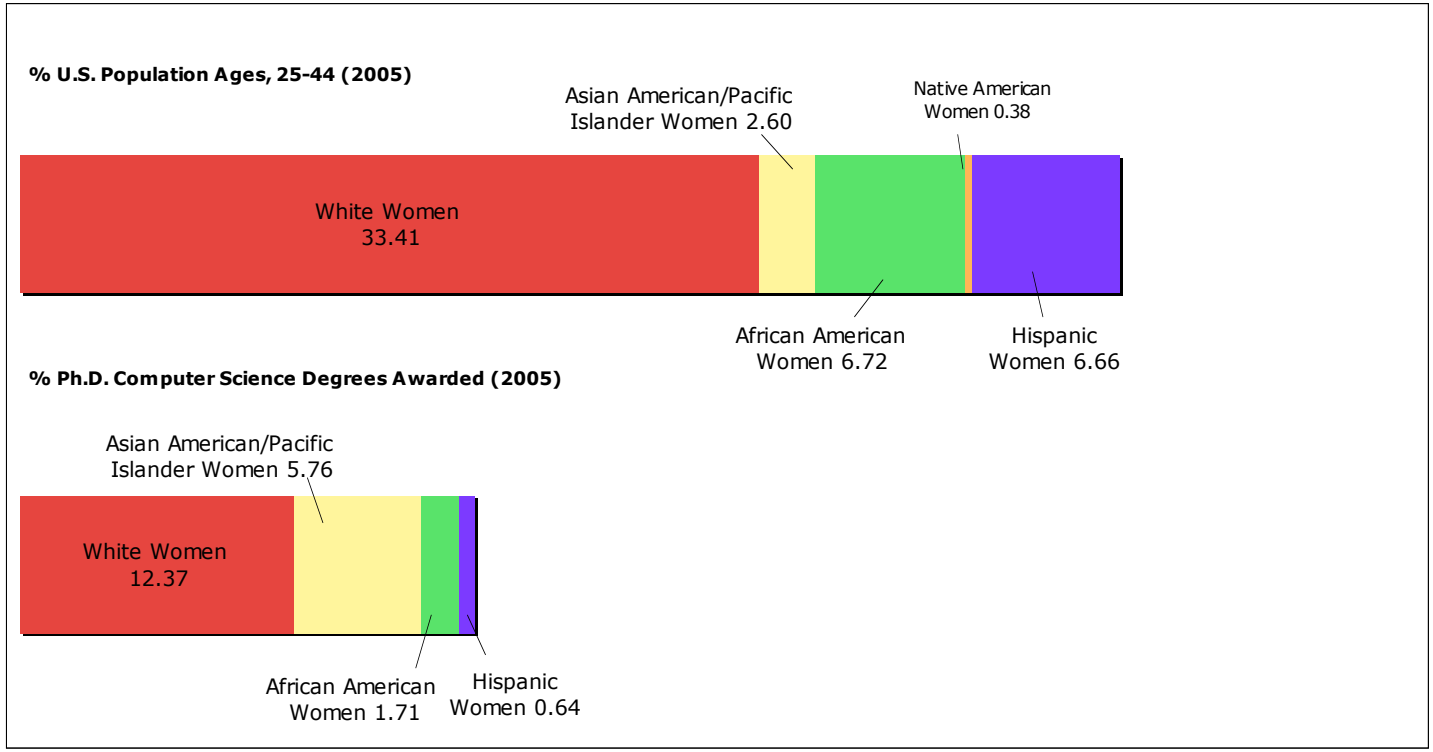
Source: National Science Board, Science and Engineering Indicators 2010

The Female U.S. Population vs. the Advanced STEM Workforce (2005)



Sources: U.S. Census Bureau (2009); NSF (2007)

The Female U.S. Population vs. the Advanced Computer Science Workforce (2005)



Sources: U.S. Census Bureau (2009); NSF (2007)

What Empirical Knowledge Do We Already Have About Women of Color in STEM?

Inside the Double Bind: A Synthesis of Empirical Literature on Women of Color in STEM

Oct. 2006 - Dec. 2009

NSF-DRL #0635577

PRESENTED BY
The Institute for Higher Education Policy

Project Team

- Maria (Mia) Ong, PI (TERC)
- Gary Orfield, Co-PI (UCLA)
- Carol Wright, Senior Researcher (TERC/MIT)
- Lorelle L. Espinosa, Senior Researcher (IHEP)
- Apriel Hodari, Senior Researcher (CNA)
- Megan Bang, Senior Researcher (TERC)
- Christine Bath, UG Researcher (REU, BU)
- William DeCarvalho, UG Researcher (REU, BU)

Methods: Search Criteria

- Pertaining to the production of US-born women who are African American, Asian American/Pacific Islander, Chicana/Latina, or Native American
- Higher education and/or on career trajectories in STEM fields
- Produced between 1970 and 2008
- Published or unpublished
- Undergraduate, graduate, postdoctoral, early/mid-career, and/or professional leadership

Methods: Search Criteria

- Only empirical works involving the intersection of race and gender were included
- Project definition of empirical work:
  - Presents a research question, research design, data collection and analysis, and findings
- Qualitative, quantitative, or mixed methods

IHEP

Methods: Data Collection & Analysis

- 48 e-database and physical library searches
  - e.g., WorldCat, ERIC Clearinghouse, Google Scholar
- 98 search terms
- Solicitation
  - 6 services and listserves (e.g., NSF GSE)
  - 18 organizations (e.g., AWIS, NSBP)
  - 15 conferences (e.g., AERA, NCORE)
  - 70 journals (e.g., JWMSE, RHE)
- Development and testing of codebook
- Synthesis

IHEP

Study Characteristics by Race/Ethnicity

Race/ethnicity	Number of Documents	Including White Women	Multiple Race/ethnicity
African American	98	20	87
Chicana/Latina	67	23	55
Asian American/Pacific Islander	45	16	40
Native American	43	20	42

Note. Columns do not add up to total study count of 116 since there may be more than one per study and since not all studies included White women.

Study Characteristics by Field and Life Stage

Field	Undergraduate	Graduate	Career
Life Science	2	1	0
Physical Science	7	3	3
Mathematics	13	2	4
General Science	23	11	15
Computer Science/Technology	9	6	5
Engineering	18	12	20
STEM	19	4	5

Note. Columns do not add up to total study count of 116 since there may be more than one life stage per study.

Study Characteristics by Design & Method

Method	Design		
	Qualitative	Quantitative	Mixed Methods
Case Study	4	-	-
Ethnography	9	-	-
Interview Study	23	-	-
Phenomenological	3	-	-
Descriptive	-	22	-
Experimental	-	12	-
Quasi-experimental	-	32	-
Mixed Methods	-	-	9
Total	**39**	**66**	**9**

IHEP

Select Findings: Undergraduate Level

- Mentorship instrumental, especially when part of a formal STEM program
- Perception by professors as a serious student important
- Positive peer experiences in formal retention programs critical
- Often use their status to harness personal empowerment
- Family may act as a crucial support ("push" factor) or discouragement ("pull factor)
- Inability to infiltrate peer groups

Select Findings: Graduate Level

- Interpersonal relationships caused more difficulty than structural barriers
- Social isolation meant few opportunities to form strong academic & social peer networks
- Social discrimination and cultural bias
- Lack of encouragement equivalent to discouragement
- Faculty mentorship rare but incredibly valuable
- "Someone who looks like me, does what I want to do"
- Funding critical to persistence

IHEP

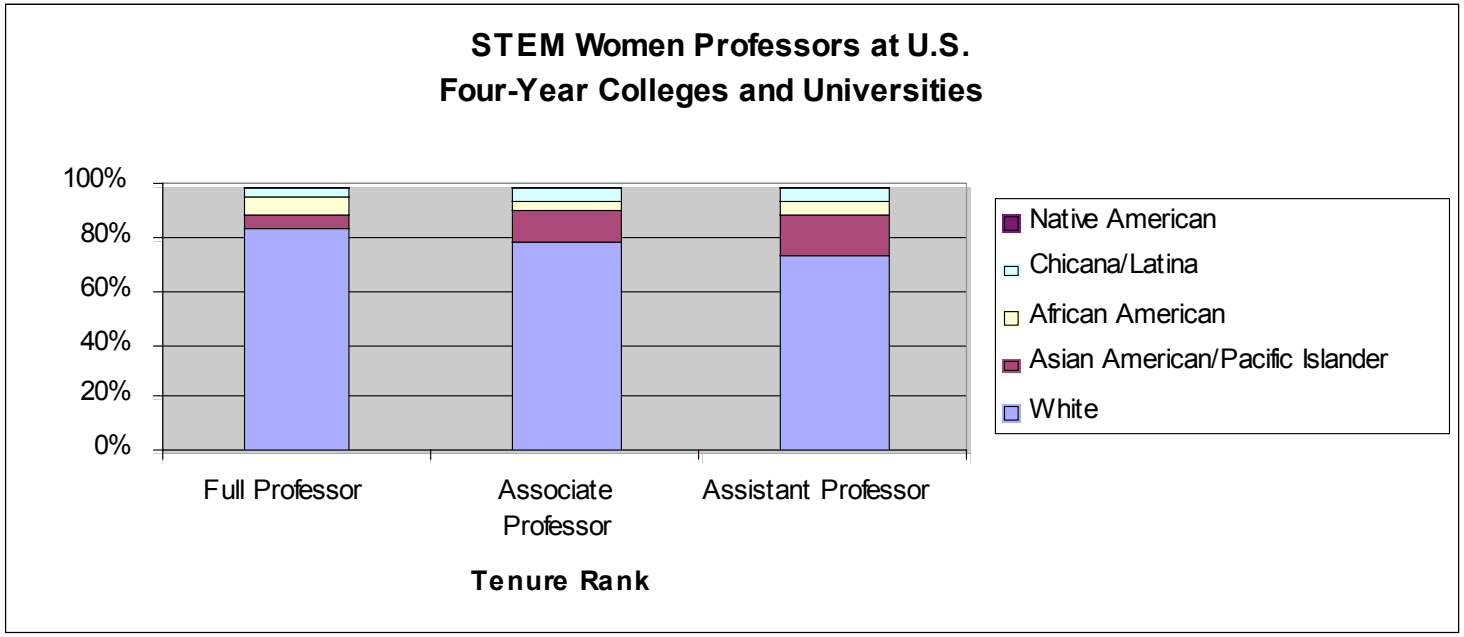
Select Findings: Graduate Level

- A sizeable number of Chicanas/Latinas and African American women have been trained at MSIs
- These schools often lack infrastructural support in STEM
- Women's colleges also often lack support but have a strong reputation for training scientists
- The transition to a R1 university is thus often wrought with academic and social barriers

Select Findings: Career Level

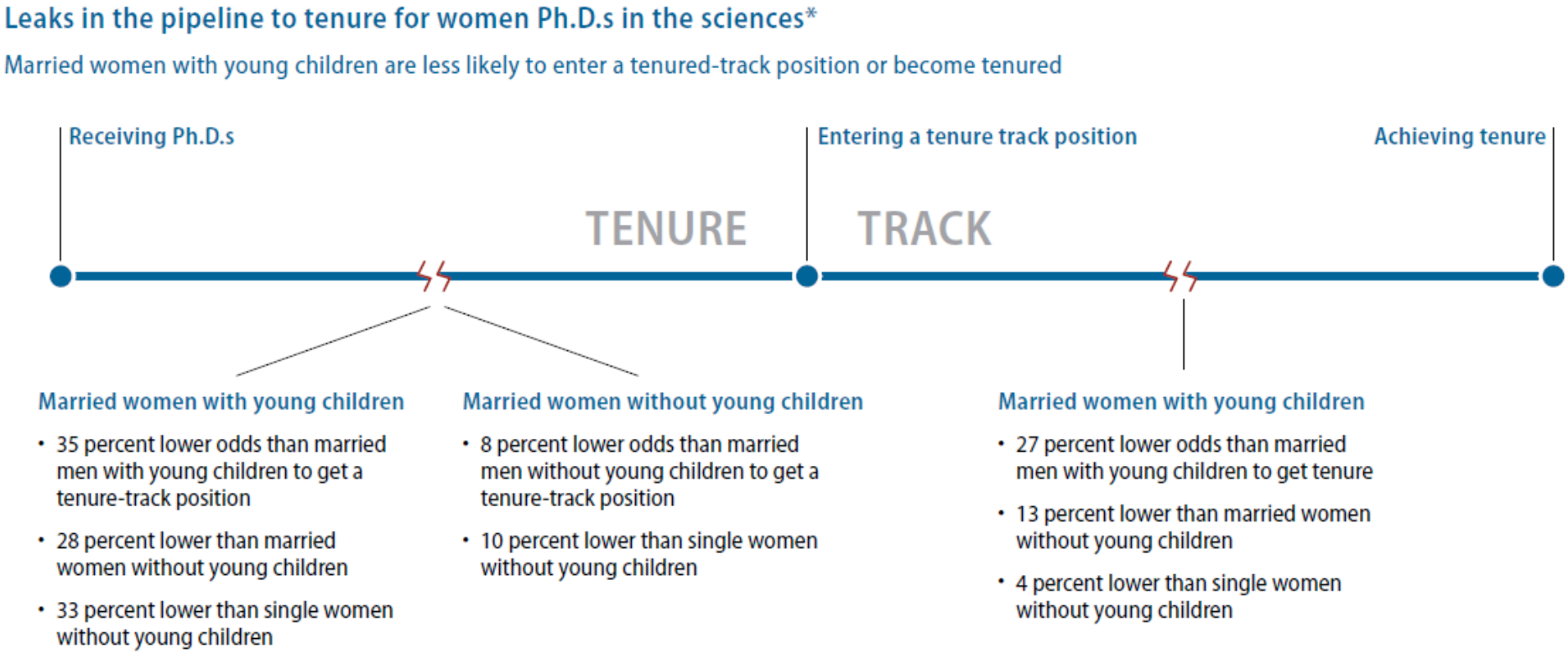
- While there is a growing number of women of color completing STEM doctoral degrees, they are not matriculating into STEM faculties and departments
- Tenure-track women of color overloaded with committee assignments, campus diversity work
- All women are severely underrepresented among the top 100 STEM departments
- Women of color concentrated at the lower end of the academic hierarchy
- Work-life balance a major consideration for pursuing research or faculty career

Women in the STEM Professoriate



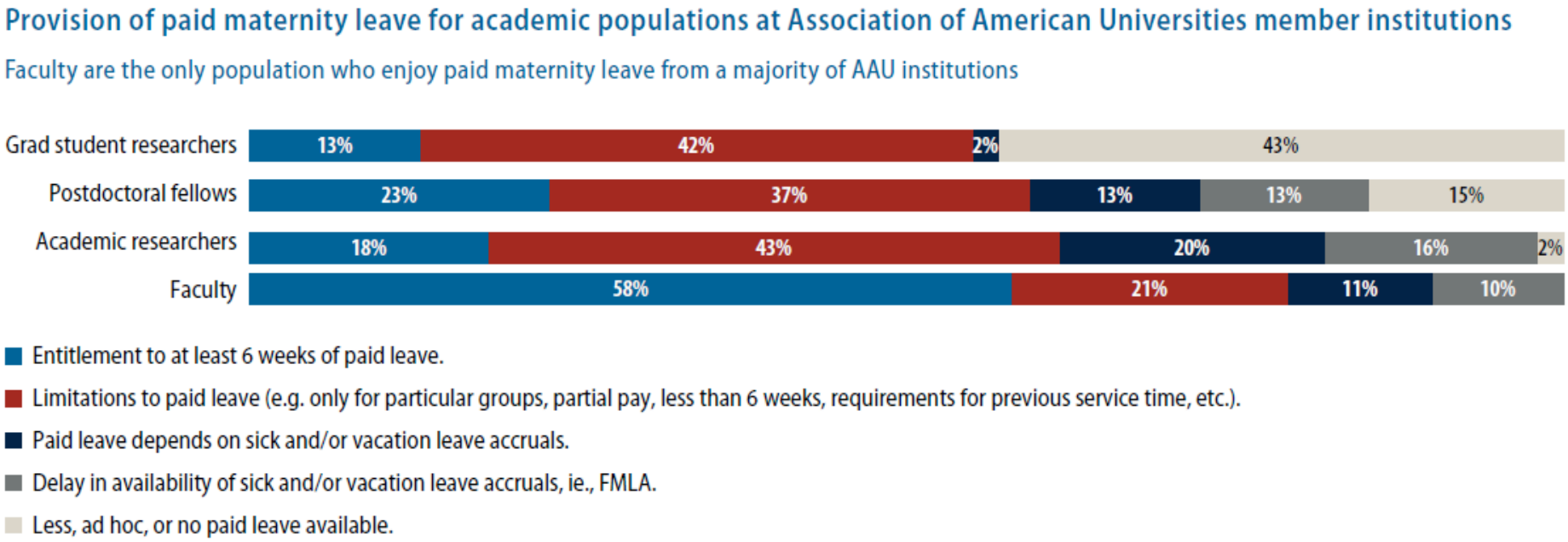
Source: NSF (2009)

Work-Family Considerations (an illustration)



Source: *Staying Competitive: Patching America's Leaking Pipeline in the Sciences*, Center for American Progress, 2009

Family-Centered Policies (or lack thereof)



Source: *Staying Competitive: Patching America's Leaking Pipeline in the Sciences*, Center for American Progress, 2009

Research Agenda and Future Action

- Overall, increased study on women of color in STEM; disaggregated data by gender/race
- Quantitative (advanced statistical analyses) and mixed-methods studies
- Longitudinal studies
- Empirical research especially on:
  - The experiences of women of Asian American, Chicana/Latina, and Native American backgrounds
  - Career trajectories of women of color, especially mid- and late-career stages

IHEP

Research Agenda and Future Action

- Research on infrastructural / institutional characteristics that promote or hinder women of color in STEM
- Research on career choice and success of women of color who began in STEM and stayed versus those who left
- Strategies to publish more studies on women of color in STEM
- Policy actions to promote women of color in STEM

Policy Recommendations

- Build on, replicate secondary and postsecondary education programs (e.g., MESA; GEM) that support interest in STEM education and careers for young women of color
- Provide funding for STEM enrichment programs that specifically target women and girls of color
- Provide funding to enable women of color students in STEM to obtain:
  - Faculty mentorship
  - Research opps., professional development opps.
  - Counseling about graduate school, careers

IHEP

Policy Recommendations

- Host a National Academies Dinner that brings together women of color STEM students, top women of color STEM professionals and educators, and others who serve this population
- Expand national agency support to encourage social science research on women of color in STEM
- Create an annual academic conference for scholars who study women of color in STEM. Provide publishing mentoring and opportunities
- Speaking of policy…

Current Policy Movement and STEM Diversity in Higher Education

PRESENTED BY
The Institute for Higher Education Policy

Historic Federal Spotlight on STEM

"Science is more essential for our prosperity, our security, our health, our environment, and our quality of life than it has ever been before."

- President Barack Obama at the 2009 National Academy of Sciences Annual Meeting

America COMPETES Act

- Legislative response to *Rising Above the Gathering Storm* and *Innovation America*
- Originally enacted in 2007
- Three major areas of importance:
  1. Increase research investment
  2. Strengthen the STEM education pipeline from elementary through graduate school
  3. Develop an innovation infrastructure

IHEP

America COMPETES *Diversity and Broadening Participation Provisions*

- Data collection on faculty demographics
- Competitive grant programs that include a focus on faculty professional development and cross-disciplinary collaboration
- Regional MSI/university/industry partnerships
- Engagement by NSF, NIH, DoE, and the National Academy of Sciences in STEM higher education (both 2- and 4-year)
- *Broadening Participation*: review boards, faculty grantees, graduate students/postdocs
- Maintains separate HBCU and TCU programs; adds distinct HSI program

IHEP

Other Federal Policy that Supports STEM Education & Diversity

Support for Minority Serving Institutions via the 2010 Health Care and Education Reconciliation Act

- Mandatory $2.55 billion for MSIs, including those serving a critical mass of Hispanics, African Americans, Alaska/Hawaiian Natives, Asian American/Pacific Islanders, and Native Americans
- Emphasis on programs that support low-income students in STEM fields

IHEP

Thank You!

Lorelle Espinosa, Ph.D.
Director of Policy and Strategic Initiatives
Institute for Higher Education Policy
lespinosa@ihep.org
www.ihep.org

Select *Inside the Double Bind* References

- Adams, J. L. (1995). Minority women in science and technology careers and attitudes towards multiple role planning. Unpublished master's thesis, Virginia Commonwealth University.
- Bellisari, A. (1991). Cultural influences on the science career choices of women. Ohio Journal of Science, 91(3), 129-133.
- Beutel, A. M. & Nelson, D. J. (2006). The gender and race-ethnicity of faculty in top science and engineering research departments. The Social Science Journal, 43(1), 14.
- Brown, S. V. (2000). The preparation of minorities for academic careers in science and engineering: How well are we doing? In G. Campbell, R. Denes, and C. Morrison (Eds.), Access denied: Race, ethnicity, and the scientific enterprise. New York: Oxford University Press.
- Coyle, N. C. (2001). Why math careers? Women's self-efficacy beliefs. Paper presented at the Annual Meeting of the Louisiana Educational Research Association, Baton Rouge, Louisiana.

IHEP

Select *Inside the Double Bind* References

- Jackson, J. (2004). The story is not in the numbers: Academic socialization and diversifying the faculty. NWSA Journal, 16(1), 172-185.
- Koelewijn-Strattner, et al. (1991). Race and gender in the chemistry profession: Double jeopardy or double negative. Paper presented at the American Sociological Association, Cincinnati, Ohio.
- National Research Council (2006). To recruit and advance: Women students and faculty in science and engineering. Washington, D.C.: National Academies Press.
- Tharp, A. M. (2002). Career development of women engineers: The role of self-efficacy and supports-barriers. Unpublished doctoral dissertation, University of Minnesota.
- Williams, L. D. (2000). The trials, tribulations, and triumphs of black faculty in the math and science pipeline: A life history approach. Unpublished doctoral dissertation. University of Massachusetts Amherst, Amherst.

IHEP