STEM Faculty: Work, Life, and Impact in the Classroom

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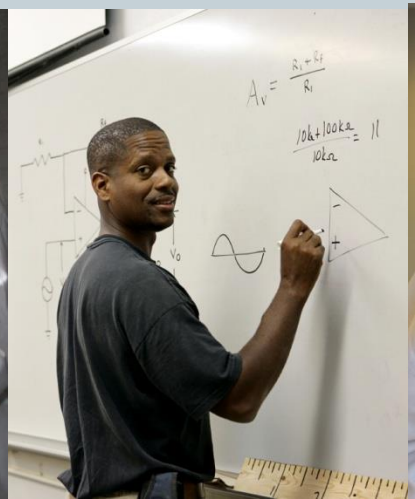



Overview of Presentation

- How URM female STEM faculty compare to their colleagues in terms of
  - Rank
  - Sources of stress
  - Workload
  - Satisfaction with compensation
  - Science identity
- Motivators of faculty's inclusion of undergraduates in research
- Talent development practices and predictors

Data Sources

HERI Faculty Survey, administered triennially

2010 Individual institutional administration

2010 STEM Supplement-NSF sponsored

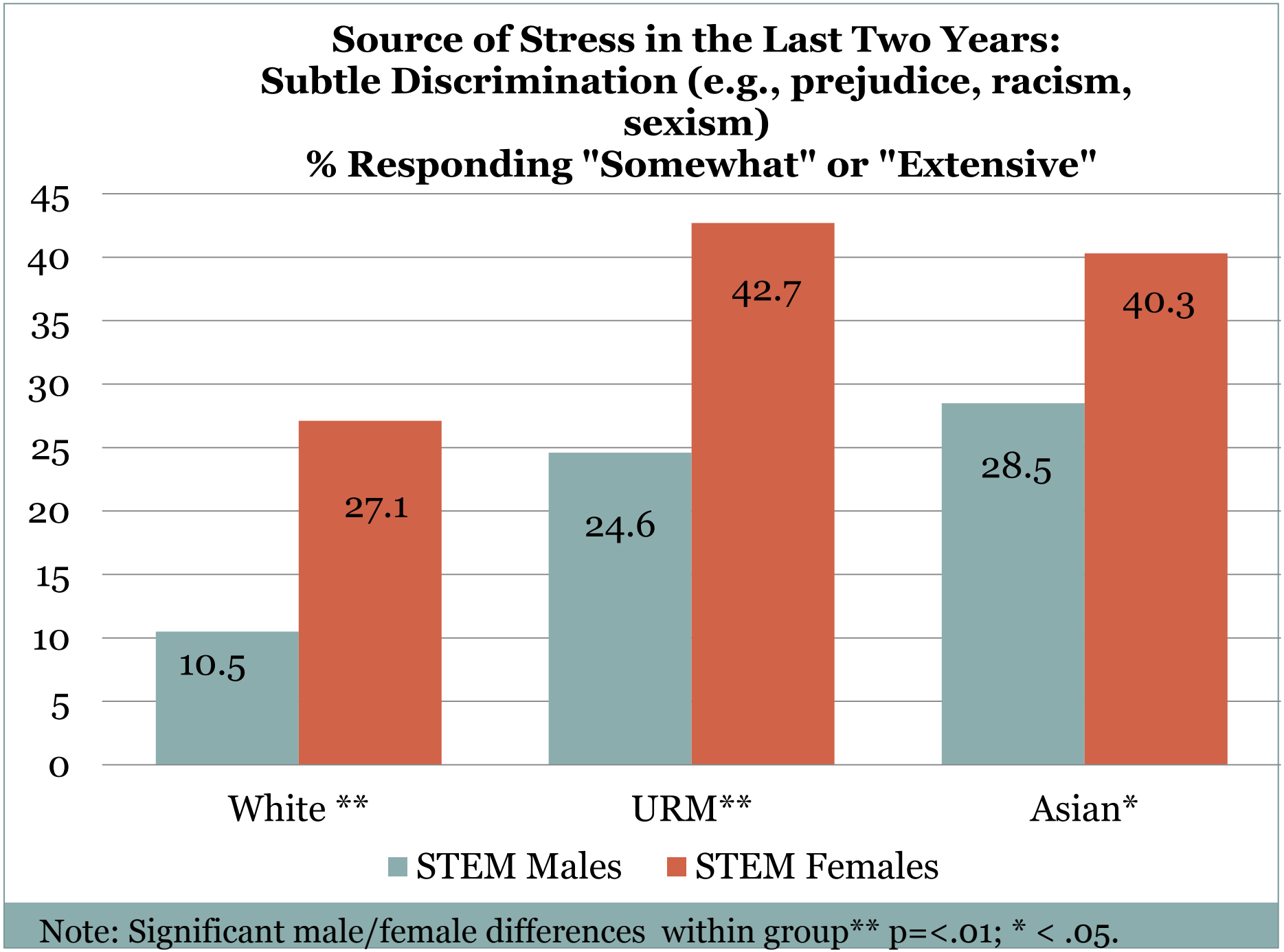
2007 98 Institutions added to augment sample

Sample: 673 four-year colleges and universities

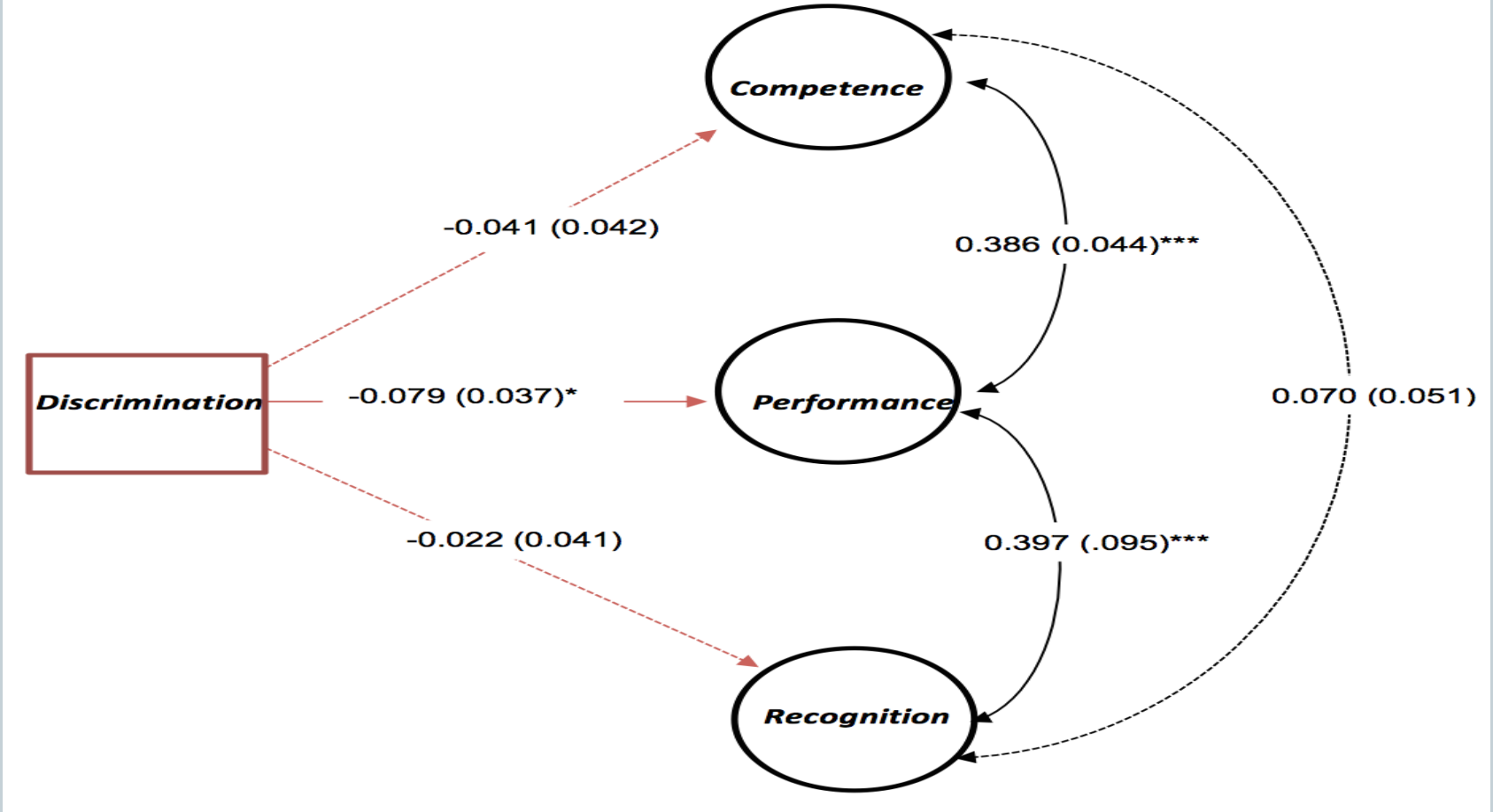
10,438 STEM faculty (unweighted)

260 Women of Color in STEM

2013 Faculty Survey: www.heri.ucla.edu


Source of Stress in the Last Two Years:
Subtle Discrimination (e.g., prejudice, racism, sexism)
% Responding "Somewhat" or "Extensive"
45
40
35
30
25
20
15
10
5
0
10.5
27.1
24.6
42.7
28.5
40.3
White **
URM**
Asian*
STEM Males
STEM Females
Note: Significant male/female differences within group** p=<.01; * < .05.

Discrimination for women of color faculty in STEM



Work Environment

My Research is Valued by Faculty in My Department	White	URM	Asian
Male	79.3**	77.0	83.3**
Female	72.7	69.7	77.6
I Have to Work Harder Than My Colleagues to be Perceived as a Legitimate Scholar			
Male	52.4**	60.1**	74
Female	66.6*	79.1	80.9

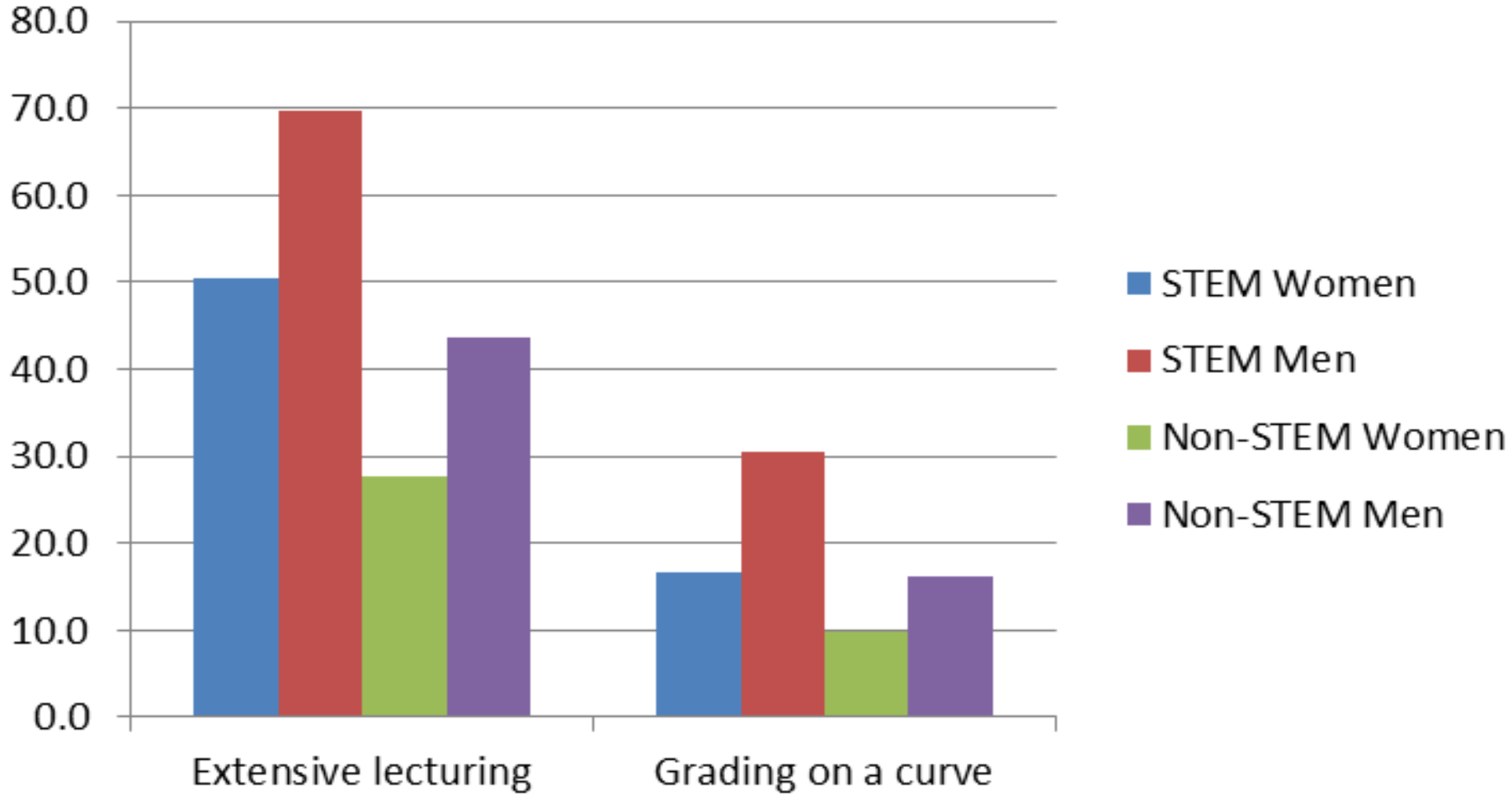
Note: Significant comparisons with URM females; **=p <.01; *=p<.05.

Workloads for STEM Tenure Track Faculty

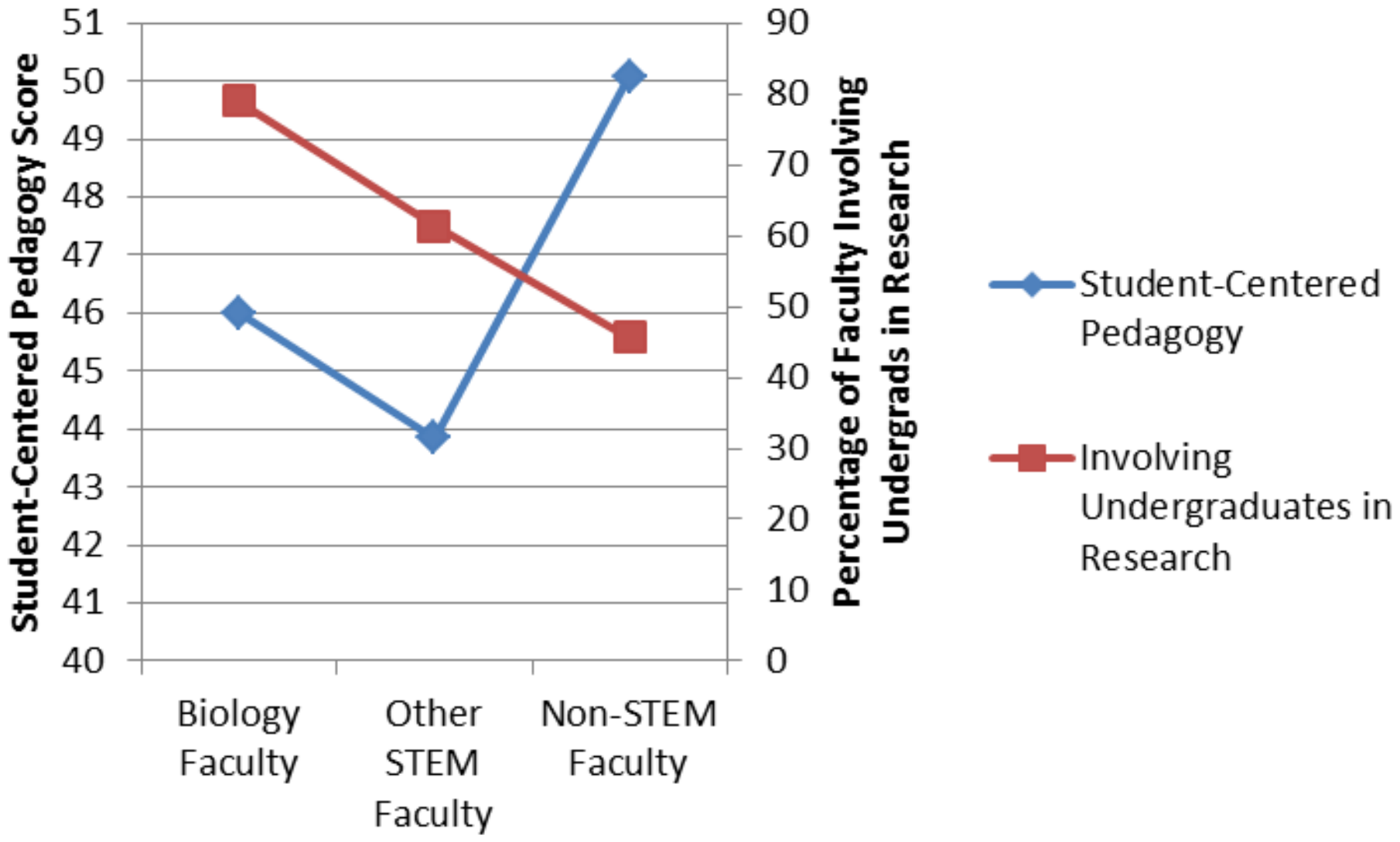
Advising Counseling Students (over 4 hrs/wk)	White	URM	Asian
Male	38.5*	42.7	43.2
Female	43.6**	48.5	44.3
Committee Work or Meetings (over 4 hrs/wk)			
Male	36.1**	38.6	32.3**
Female	43.8 **	48.5	40.8
Research and Scholarly Writing (over 4 hrs/wk)			
Male	59.8*	66.2**	73.3**
Female	44.9 **	49.5	60.2*

Note: Significant differences with URM females, **= p<.01; *=p<.05.

Extensive Lecturing and Curve Grading, by Sex and Discipline
(% Using in All or Most Classes Taught)



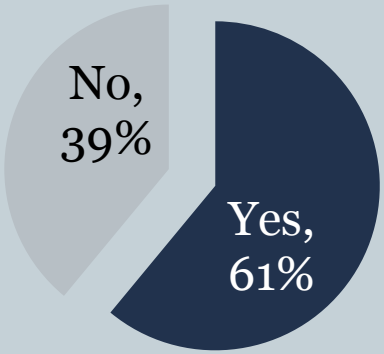
Disciplinary Differences in Faculty's Use of Student-Centered Pedagogy and Involvement of Undergraduates in Research



Faculty Engaging Undergraduates in Research

Data Source and Sample

- Data
  - 2007-2008 HERI Faculty Survey
    - 4,765 STEM faculty members from 193 institutions
- Dependent Variable:
  - *During the past two years, have you engaged undergraduates on your research project (Yes = 1, No = 0)*



Results

Level-1 Predictors	**Delta-P**
Professional Career	
Time since appointed at present institution	-0.48%
Discipline (Biological/Life sciences is reference)	
Engineering and Computer Sciences	-17.04%
Health Sciences	-34.55%
Physical Sciences	-19.97%
Teaching Activities	
Taught an honors course	9.63%
Taught an interdisciplinary course	5.76%
Number of graduate courses taught	-3.69%

Results

Level-1 Predictors	Delta-P
Scholarly Activities (other than teaching)	
Collaborated with the local community in research/teaching	7.94%
Advised student groups involved in service/volunteer work	7.08%
HPW engaged in research/scholarly writing	4.87%
Extent: engage in academic work spanning multiple disciplines	5.51%
Extent: mentor new faculty	5.09%
Publications and Funding	
Number of articles published in academic/prof. journals (career)	4.41%
Number of published books, manuals or monographs (career)	-3.87%
Source of stress: Research or publishing demands	8.58%
Received funding for work from foundations	8.58%
Received funding for work from state or federal government	13.22%
Received funding for work from business or industry	7.73%

Results

Level-2 Predictors	**Delta-P**
HBCU	17.03%
Liberal Arts Institution (Carnegie)	13.03%
Institutional Selectivity (in 100-point increments)	3.50%
Model Statistics	
Explained variance at Level 2	0.59
Baseline probability of inclusion of undergrads in research	0.61

Talent Development: Practices & Predictors

I really was motivated to make a difference in terms of our underrepresented minorities…I had gotten some data that suggested there was a big achievement gap for our black students in my class…So it just really hit me deeply [because] I know these students come in [from] different places. But I just felt like maybe I could do something to help them all get to a more similar place in my class.
– *Biology Instructor, Exemplar Institution*

Talent Development Studies

- Cultivating STEM Talent: Lessons from STEM Pioneers and Exemplar Institutions
  - *Intro classroom data* - 26 faculty at 8 institutions (1 HSI, 1 HBCU, 6 PWI)
  - *Case study of exemplar institutions* – 20-25 faculty, program directors, and administrators at 6 institutions (1 HBCU, 1 Tribal, 2 HIS, 2 PWI)
  - *STEM Pioneer data* – 32 pioneers across varied STEM disciplines
- Understanding the STEM Faculty Approaches to Student Talent Development
  - 2013-2014 Faculty Survey
  - 5,465 STEM faculty from 254 four-year institutions
  - Hierarchical Linear Modeling (HLM)

Lessons from STEM Pioneers and Exemplar Institutions

Traditional definition of scientific talent

- Used test scores & curved grading
- Grades as a proxy for students' work ethic, attention to detail, or passion

Broader definitions of scientific talent

- Talent is fluid, developmental characteristic
- Different types of talent (ex: lab skills, class knowledge)
- About being a leader, having an inquisitive mind, asking questions, thinking out of the box, displaying comfort with ambiguous problems
- A student can struggle with grades and still be viewed as talented
- Excited to do science, persistent in the face of challenges, use existing knowledge to mentor others, use science as a means to improve society
- Coincided with the view that all STEM students should be supported to acquire greater skills and to reach their full potential
- Inclusion & talent development in the classroom = Social justice imperative

Cultivating STEM Talent

Faculty members actively discussed how *their* teaching contributes to the academic success of students

- As I get more and more experience [with active learning], I do a much better job with metacognition and inclusiveness…**We looked at some survey data and…also found out that there was a participation gap**, so our underrepresented minority students didn't feel comfortable participating in the big traditional classroom. But when they get a chance to just talk to neighbors, there is no longer a reason that they wouldn't participate – *Biology Instructor, Exemplar Institution*

Cultivating STEM Talent

Faculty members actively discussed how *their* teaching contributes to the academic success of students

- The first and most important lesson I've learned is to **appreciate the difficulty that some students have with the material and to make sure that they don't feel judged for the difficulty** that they're having, to express the idea that some of this material is challenging, it is different from anything that they've had before. Some of it is not intuitive, and that's okay. It's okay to struggle with it, and many people do. They won't be judged harshly for not getting it right away. — *Professor in Ecology and Evolutionary Biology, Introductory Classroom Data*

Understanding Talent Development Approaches

- Lessons from Pioneers & Exemplar Institutions
  - *Student-level characteristics of evaluating students' scientific talent and promise for conducting science*
  - *Faculty discussing that they are responsible for identifying and cultivating that talent through their classroom practices*
- Understanding Talent Development Approaches
  - *What predicts how frequently faculty employ these classroom practices to identify and cultivate student talent?*
  - Dependent variable: Classroom-level talent development approach

Understanding Talent Development Approaches

	T-ratio	b	Sig.
Faculty Characteristics			
Instructor (Ref: Full Professors)	3.704	2.10	***
Lecturer (Ref: Full Professor)	3.116	1.83	**
Life Sciences (Ref: Physical Sciences)	-5.807	-1.80	***
Engineering (Ref: Physical Sciences)	-3.024	-1.20	**
Health Sciences (Ref: Physical Sciences	-5.769	-2.13	***
Research Activities with Undergraduate Students			
Research with undergraduate students	4.040	.07	***

Understanding Talent Development Approaches

	t-ratio	b	Sig.
Teaching Activities			
Taught an honors course	2.345	.67	*
Taught a seminar for first-year students	2.554	.68	*
Hours per week: Preparing for teaching	6.057	.43	***
Hours per week: Advising and counseling students	3.144	.39	**
Hours per week: Committee work and meetings	-0.202	-.03	***
Mentor undergraduate students	12.531	3.60	***
Importance: Teaching	3.915	1.40	***

Understanding Talent Development Approaches

	t-ratio	b	Sig.
Classroom Teaching Practices			
Extensive Lecturing	-0.616	-.09	
Using real-life problems	2.747	.40	**
Using student inquiry to drive learning	7.760	**1.28**	***
"Learn before lecture" using multimedia tools (e.g. flipping the classroom)	3.935	.47	***
Supplemental instruction that is outside of the class and office hours	1.968	.25	*
Grading on a curve	0.828	.08	
Student Centered Pedagogy	8.925	.17	***
Institutional Characteristics (Level 2)			
Control (Public = 1 vs. Private = 2)	-3.017	-1.02	**
Research (Ref: Masters)	-2.011	-.88	*

Discussion

- Faculty members' attitudes toward scientific talent matters for student success, and there are certain practices that demonstrate that

- Importance of mentoring undergraduate students
- Differences in professional characteristics
- Classroom and institutional conditions matter