



# A Joint Venture: Universities, Students and Other Stakeholders Achieving High Quality Doctoral Education

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The American Association for the Advancement of Science  
The 3rd Annual AGEP Evaluation Capacity Building Meeting on  
Designing an Evaluation Framework for  
Retaining Students in STEM PhD Programs  
San Juan, Puerto Rico  
February 1, 2007

by  
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# Doctoral Facts

## The National Picture

- Approximately 1.2% of the U.S. adult population age 25 and over has a doctoral degree.
- The United States awarded approximately 43,354 doctoral degrees in 2005.
  - Of the 1,999 engineering Ph.D.s awarded to US citizens in 2005
    - 73 (3.6%) were awarded to Hispanics (Puerto Rican, Mexican, Other Hispanic)
    - 85 (4.2%) to Black, Non-Hispanics
- Fall 2001 full-time instructional faculty (617,868),
  - Black, Non-Hispanic – 31,681 (5%)
  - Hispanic – 18,514 (3%)
  - American Indian/Alaskan Native – 2775 (<1)

THREE  
MAGIC  
LETTERS

GETTING TO

PH.D.

MICHAEL T. NETTLES

CATHERINE M. MILLETT



# Survey of Doctoral Student Finances, Experiences and Achievements Three Stage Sampling Plan

- Stage 1 - selected 21 diverse doctoral granting universities
- Stage 2 - selected 11 fields of study
- Stage 3 - selected a stratified sample of 13,160 doctoral students who completed at least one year of study and who were taking at least 6 credit hours in the fall term 1996
  - 9,036 students completed surveys (70% response rate)

Source: Nettles & Millett, Survey of Doctoral Student Finances, Experiences and Achievements



# Participating Institutions

- **Clark Atlanta University**
- **City University of New York**
- **Columbia University**
- **Harvard University**
- **Howard University**
- **Indiana University**
- **New York University**
- **Ohio State University**
- **Princeton University**
- **Rutgers University**
- **Stanford University**
- **Teachers College**
- **Temple University**
- **University of California at Berkeley**
- **University of California at Los Angeles**
- **University of Maryland**
- **University of Michigan**
- **University of North Carolina - Chapel Hill**
- **University of Texas**
- **University of Wisconsin**
- **Vanderbilt University**

Source: Nettles & Millett, Survey of Doctoral Student Finances, Experiences and Achievements

# 5 Fields of Study

- Science & Math - biology, chemistry, physics, math
- Social Sciences - economics, political science, psychology, sociology
- Humanities - English, history
- Education
- Engineering - chemical, electrical, mechanical

Source: Nettles & Millett, Survey of Doctoral Student Finances, Experiences and Achievements



# Survey of Doctoral Student Finances, Experiences & Achievements (28 page survey)

- Application & enrollment
- Current doctoral program experience
- Attendance patterns
- Financing doctoral education
- Future plans
- Undergraduate experiences
- Background

Source: Survey of Doctoral Student Finances, Experiences and Achievements.



# Research Questions about Doctoral Students

1. What are the quality of performance, experiences, and professional training and development?
2. How do indebtedness and financial assistance relate to the success?
3. How do academic and personal background relate to support, experiences, achievements? And
4. How do graduate institutions ensure Student success?



# Doctoral Student Experience Conceptual Model

## Background Characteristics

- Gender
- Race
- Parent SES
- Married/  
domestic partner
- Household Income
- Have kids under 18
- Age

## Outcomes

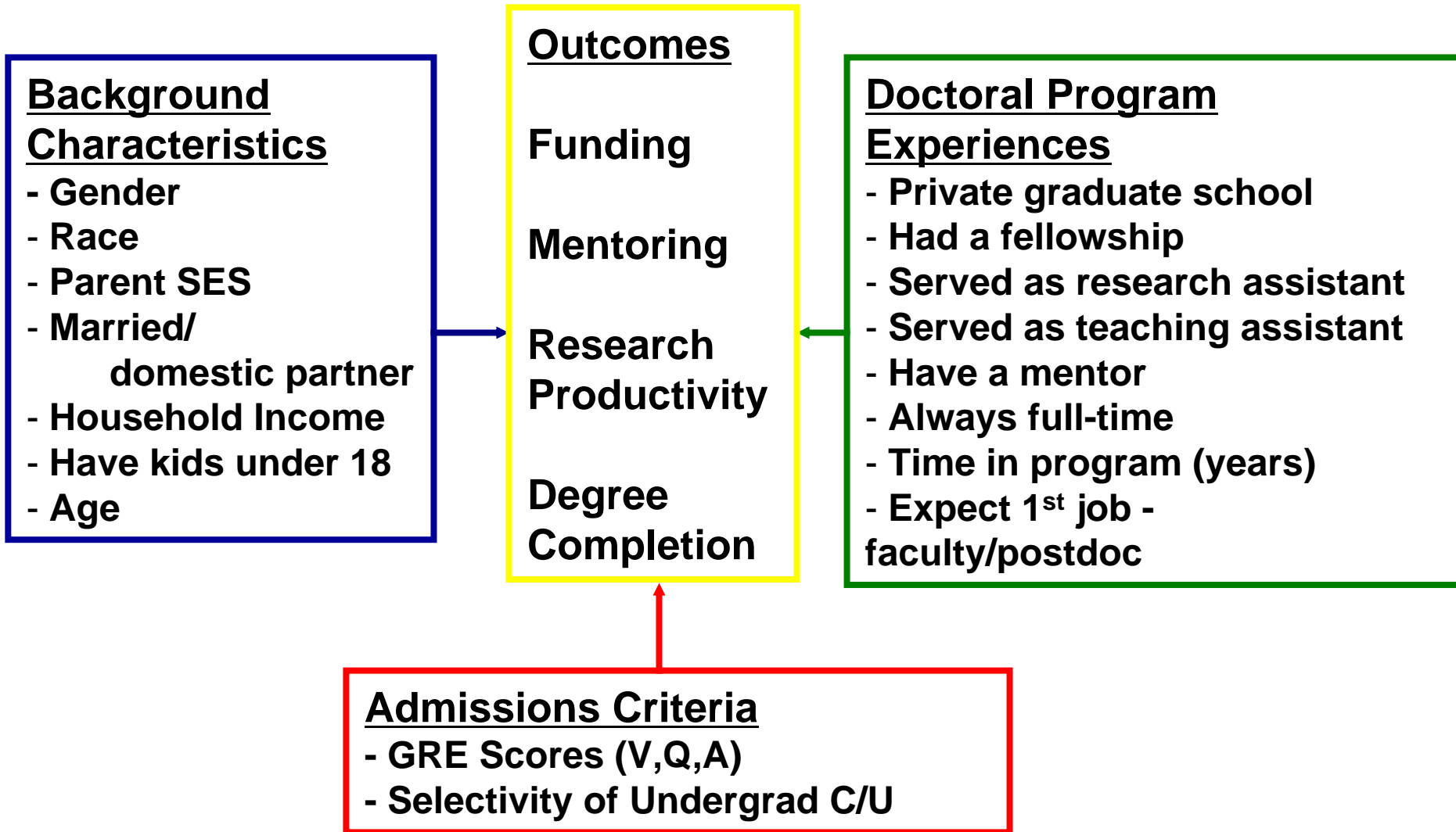
- Funding
- Mentoring
- Research Productivity
- Degree Completion

## Doctoral Program Experiences

- Private graduate school
- Had a fellowship
- Served as research assistant
- Served as teaching assistant
- Have a mentor
- Always full-time
- Time in program (years)
- Expect 1<sup>st</sup> job -  
faculty/postdoc

## Admissions Criteria

- GRE Scores (V,Q,A)
- Selectivity of Undergrad C/U



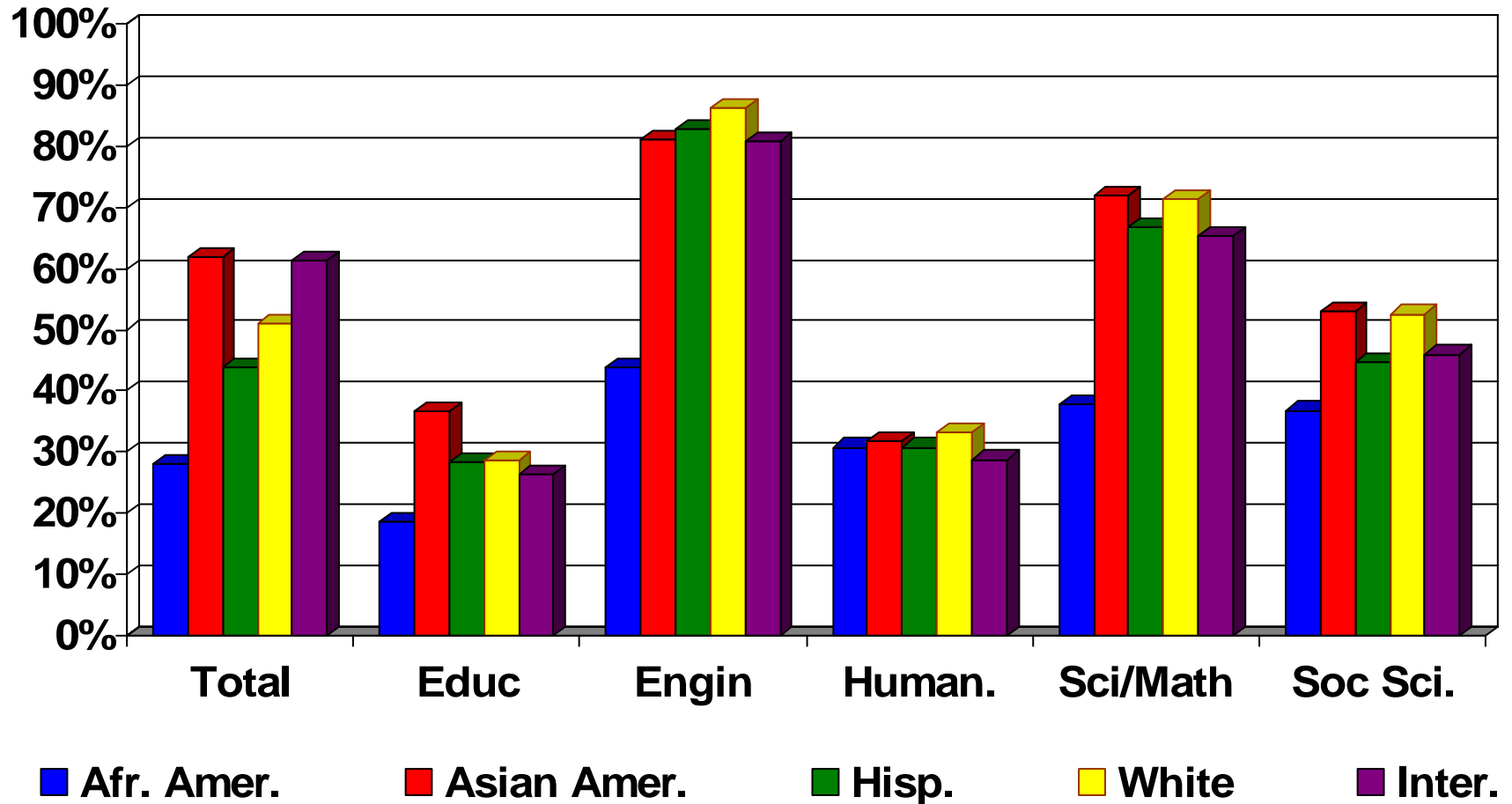
# Funding

## Our Working Definitions

- **Fellowships:**
  - monies and/or tuition and fee waivers given to students with no expectation of repayment or of services to be rendered.
- **Research Assistantships**
  - monies (tuition/fees and/or a stipend) given to students with the expectation of research services to be rendered.
- **Teaching Assistantships**
  - monies (tuition/fees and/or a stipend) given to students with the expectation of teaching services to be rendered.

# Receiving a Research Assistantship During Doctoral Varies by Field of Study

- African American & Hispanic students ever having a research assistantship is significantly different from Whites overall.
- African American students differ from White students in all field except Humanities.
- Within field, Hispanic students did not differ from White students.



# What Predicts Being a Research Assistant?

- African American students were less likely to be RAs in engineering and science/math.
- In engineering & science/math, having a fellowship was a negative predictor of being an RA.
- Being a TA was a positive predictor of being an RA in all fields except engineering.

	Educ.	Engin.	Human.	Science/ Math	Social Science
Male					-
African-American	-	-		-	
Hispanic-American	-				
Asian-American					
International	-	-			-
Age at start of prog	-	-		-	-
Ever had Fellowship	+	-	+	-	
Ever Teaching Assit	+		+	+	+
Private grad school	-				-
Time in program	+	+		+	+
First job fac./postdoc				-	+

**Negative signs** = less likely to have been an RA. **Positive signs** = more likely to have been an RA.

# Being a Research Assistant Can Influence Other Doctoral Experiences

## Ever Research Assistant

### Influences \*

- Acquiring debt during program
- Ever receiving a fellowship
- Ever being a teaching assistant
- Social interaction with peers
- Academic interactions with faculty
- Interactions with faculty advisor
- Presenting a paper at a conference
- Publishing an article
- Overall research productivity
- Stopping out of a doctoral program
- Rate of progress in program
- Degree completion

### No Influences

- Student – faculty social interactions
- Satisfaction with doctoral program
- Time to Degree

\* Note: Influences may not be in all fields

# Mentoring

“Mentors, unlike advisors, cannot be assigned to specific students. Advisors may be mentors, but many advisor-advisee relationships never evolve to the mentor-protégé relationship”  
(Willie, Grady & Hope, 1991, p. 72)

# Faculty Advisor (B-6)

- A faculty or research advisor is a person assigned by your department/program to act in an official capacity in such ways as discussing and approving your coursework, or signing registration forms. Please note that your faculty or research advisor may not be your mentor. Do you have a faculty member who serves as your advisor?

- \_\_\_\_\_ 1. Yes
- \_\_\_\_\_ 2. No (If 'NO,' **GO TO B-9**)

Source: Survey of Doctoral Student Finances, Experiences and Achievements.



# Mentor Question (B-9)

- Many doctoral students have someone on the faculty to whom they turn for advice, to review a paper, or for general support and encouragement. This person may be thought of as a mentor. If you have more than one mentor, please comment on the one with whom you work most closely. Do you have a faculty member who serves as your mentor?

- \_\_\_\_\_ 1. Yes  
\_\_\_\_\_ 2. No (If 'NO,' **GO TO B-13**)

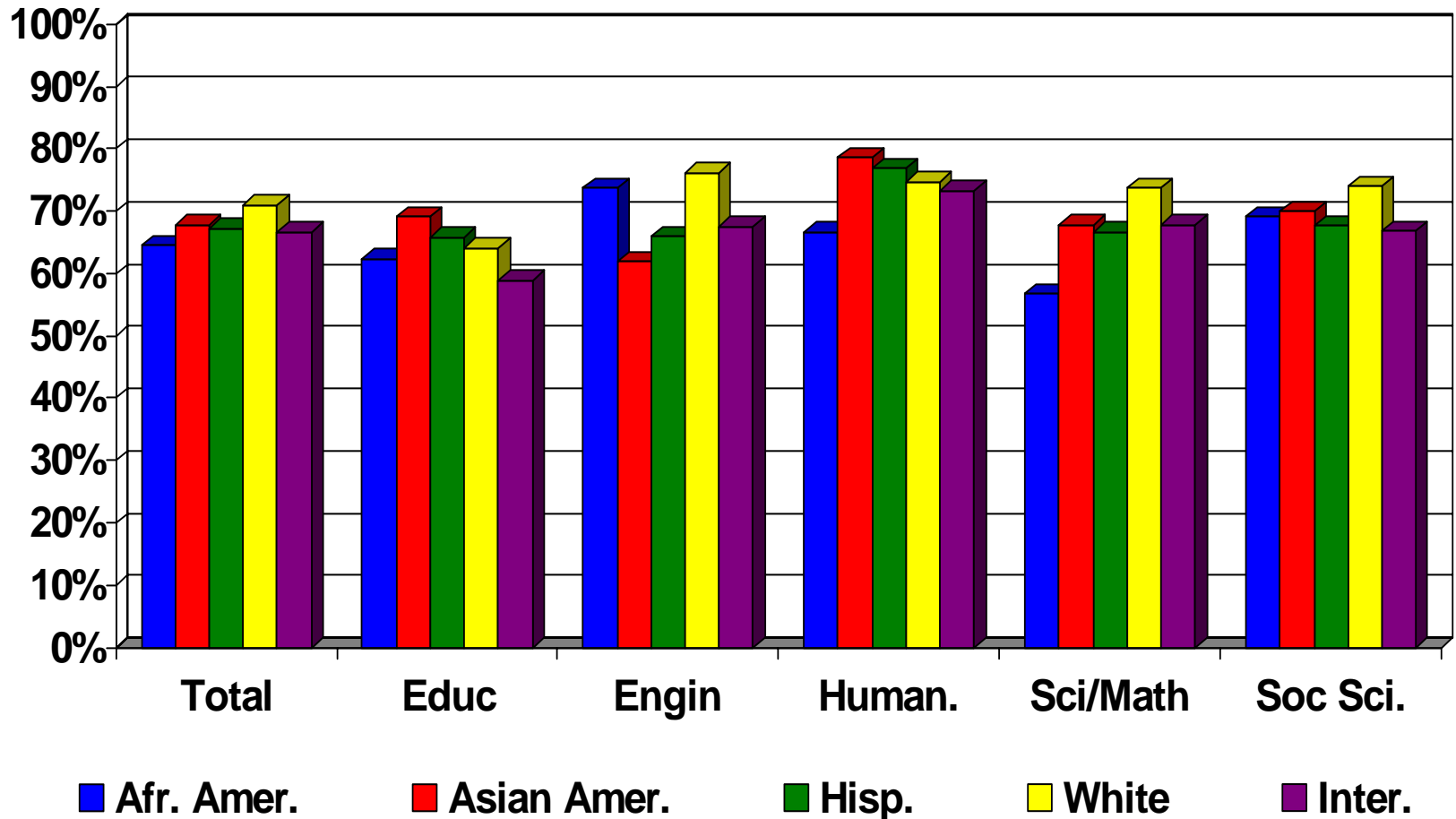
Source: Survey of Doctoral Student Finances, Experiences and Achievements.





# Nearly 70% of Doctoral Students Have a Mentor

- African American students having a faculty mentor is significantly different from White students overall and in Science & Math.
- Hispanic students do not differ from White students in the overall or within fields.



Source: Survey of Doctoral Student Finances, Experiences and Achievements.

# What admission characteristics predict having a mentor?

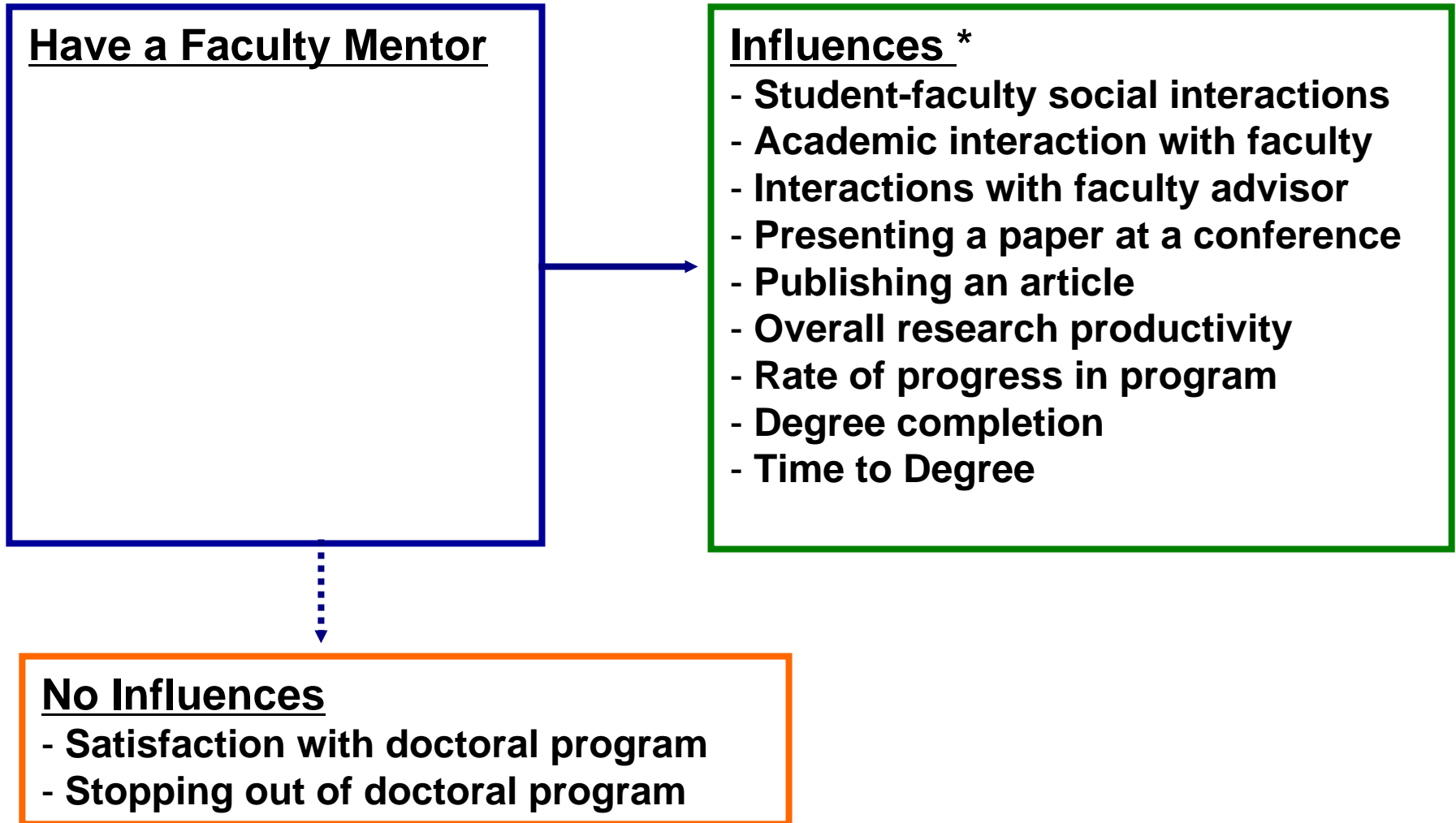
- In engineering, race/ethnicity, parental socio-economic status and performance on the Verbal section of the GRE influence the odds of having a mentor.
- In science/mathematics, race/ethnicity, parental socio-economic status, performance on the Verbal section of the GRE and the type of graduate school influence the odds of having a mentor.

	Educ.	Engin.	Human.	Science/ Math	Social Science
Male			-		
African-American				-	
Hispanic-American					
Asian-American		-			
International	-	-			
Parents' SES		+		+	+
GRE Verbal (100 pt)		-			
GRE Quant (100 pt)				-	
Private grad school	-			-	

Negative signs = less likely to have been had a faculty mentor.

Positive signs = more likely to have had a faculty mentor.

# Having a Mentor Can Influence Other Doctoral Experiences



\* Note: Influences may not be in all fields

# What is the Research Productivity of Today's Doctoral Students?

## **Individual Measures: (joint or sole authored)**

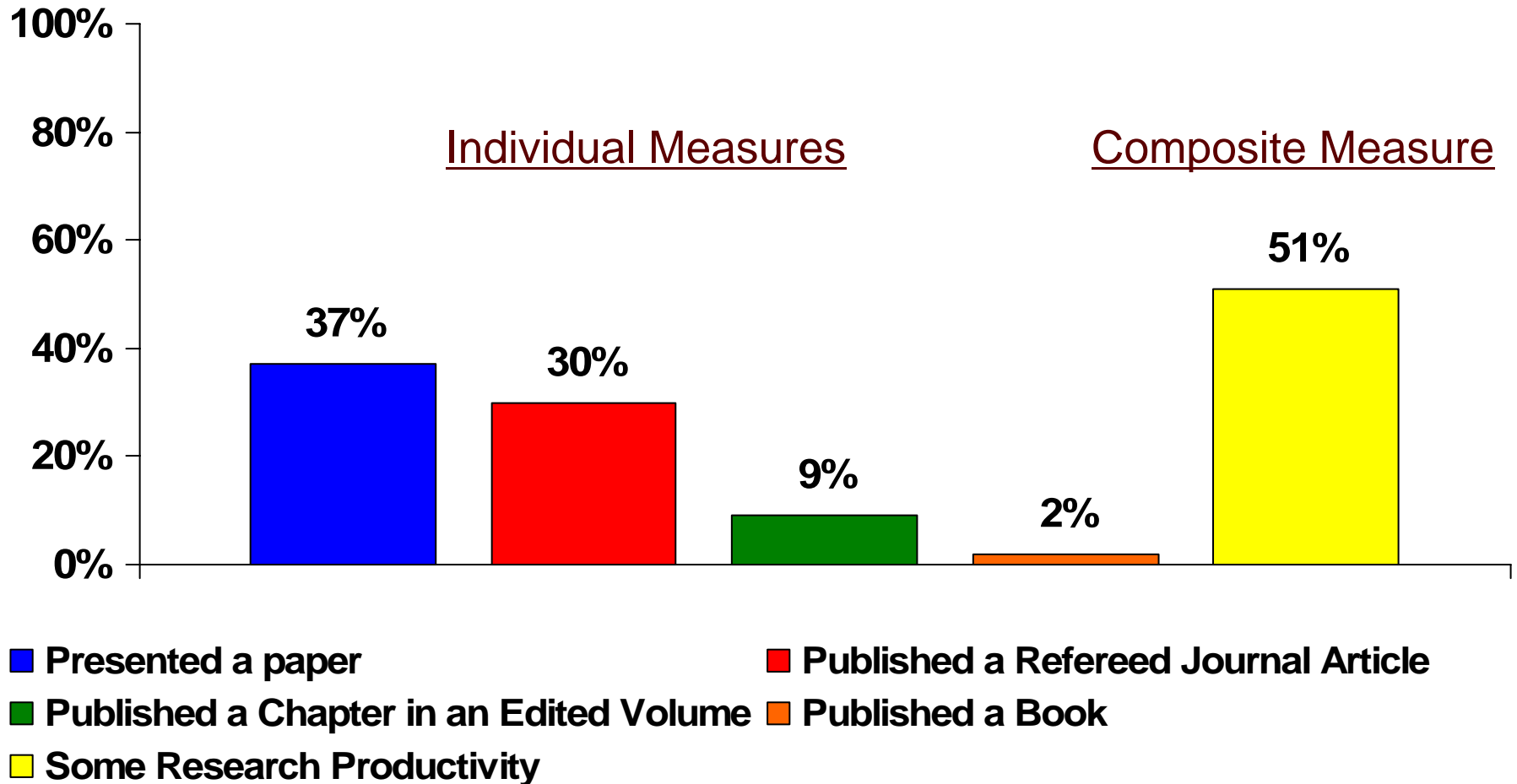
- Presented a paper
- Published a chapter
- Published a refereed article
- Published a book

## **Composite Measure:**

- Some research productivity

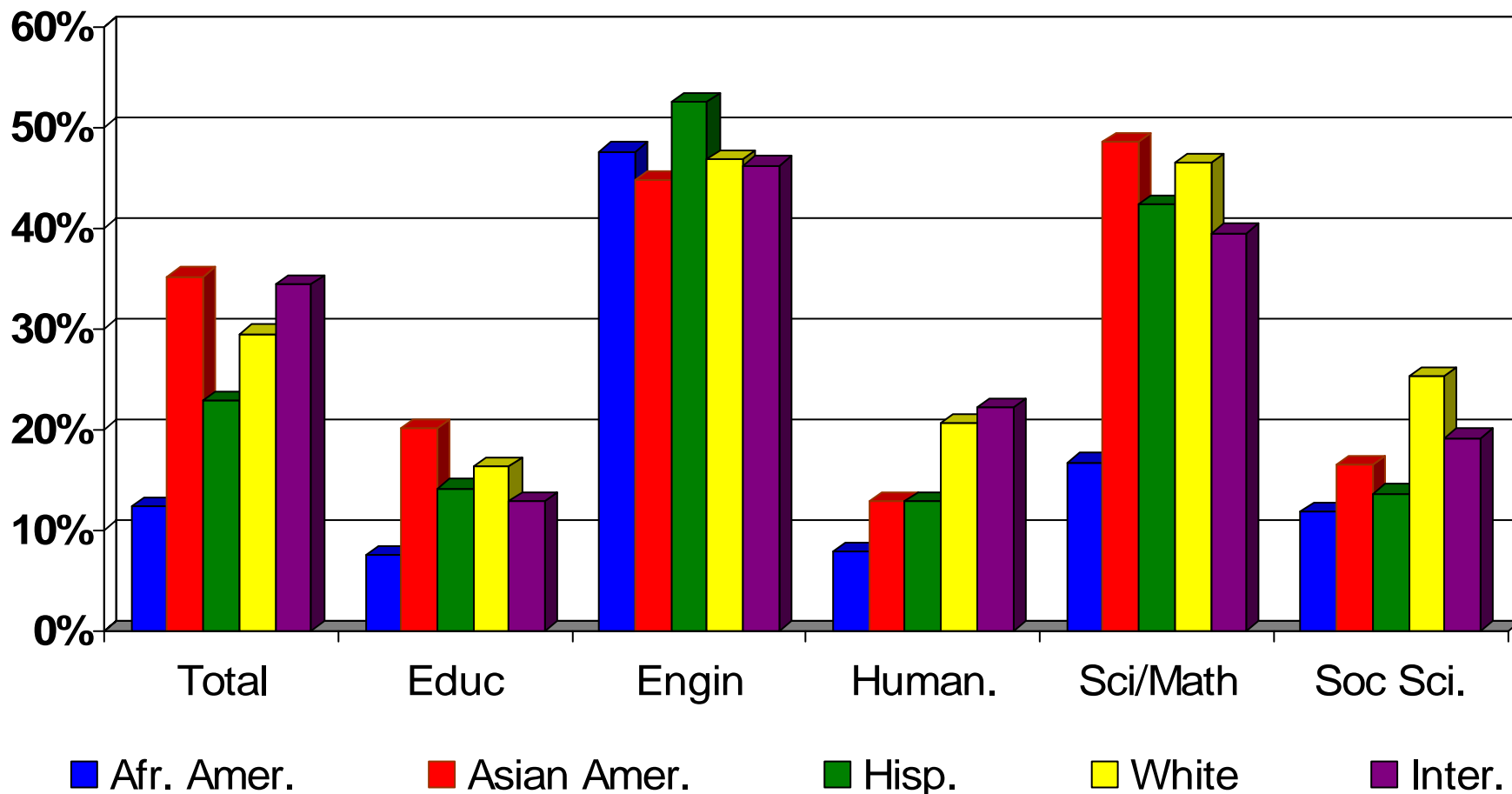
# Doctoral Students Reports of Achieving An Individual Measure at Least Once

- Created a composite measure that captures whether a student achieved at least one of the individual measures once.



# Doctoral Students are Publishing Refereed Journal Articles (sole or joint authored)

- African American & Hispanic students rates of publishing an article are significantly different from Whites in the total.
- Within fields, African American students differ from White students in education, science & math, and the social sciences.
- Within fields, Hispanic students do not differ from White students.



Source: Survey of Doctoral Student Finances, Experiences and Achievements.

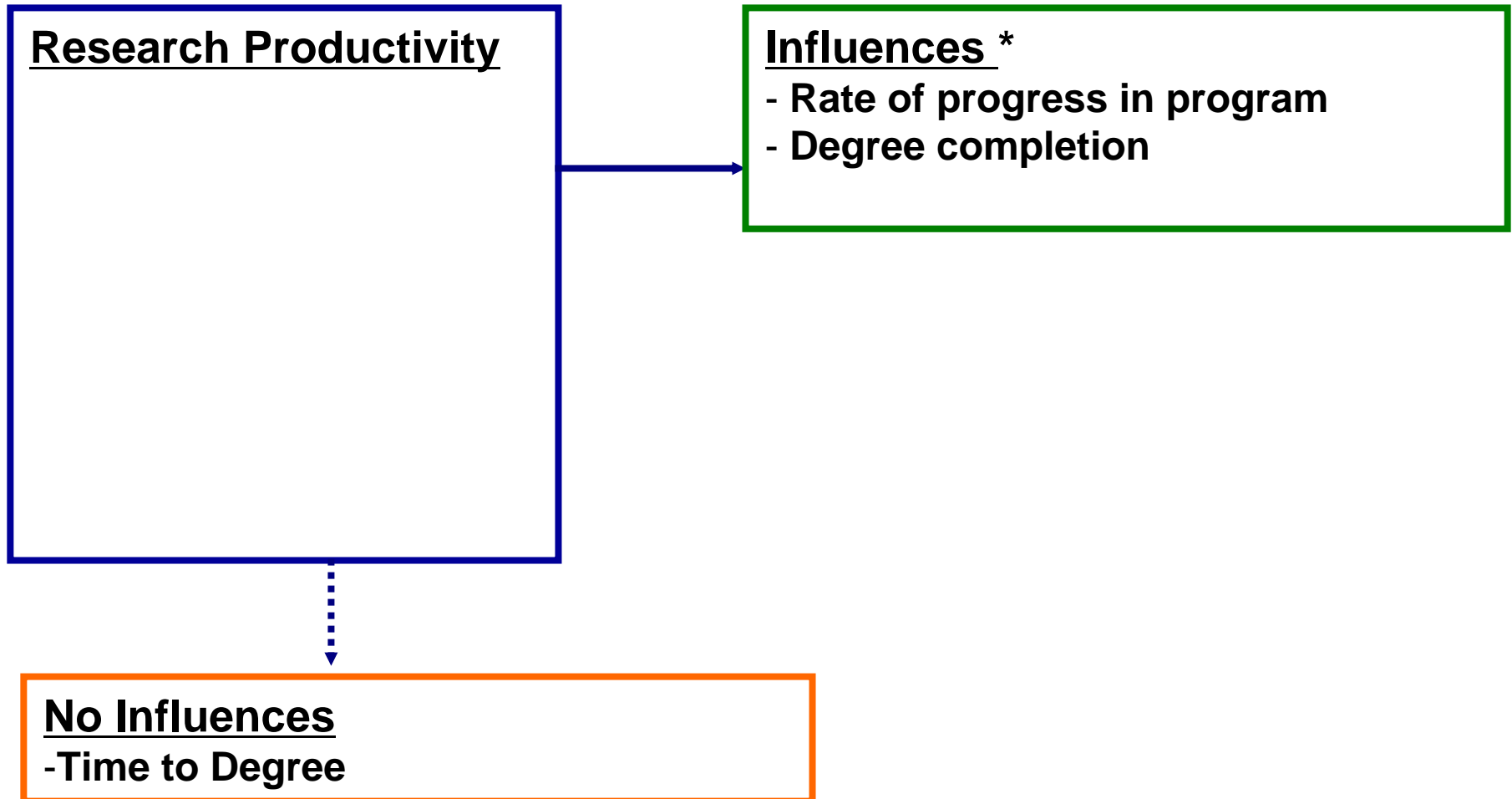
# Being a Research Assistant and Mentoring Positively Influence Article Publication

	Educ.	Engin.	Human.	Science/ Math	Social Science
Male		+		+	
African-American	-			-	-
Hispanic-American					-
Asian-American					
International					
Private grad. school	-			+	
Research assistant	+	+		+	+
Teaching assistant	+		+	-	
Has a mentor	+	+		+	+
Time in program	+	+	+	+	+
First job fac./postdoc	+				+

Negative signs = less likely to have written a refereed journal article.

Positive signs = more likely to written a refereed journal article.

# Research Productivity Can Influence Other Doctoral Experiences



**\* Note: Influences may not be in all fields**

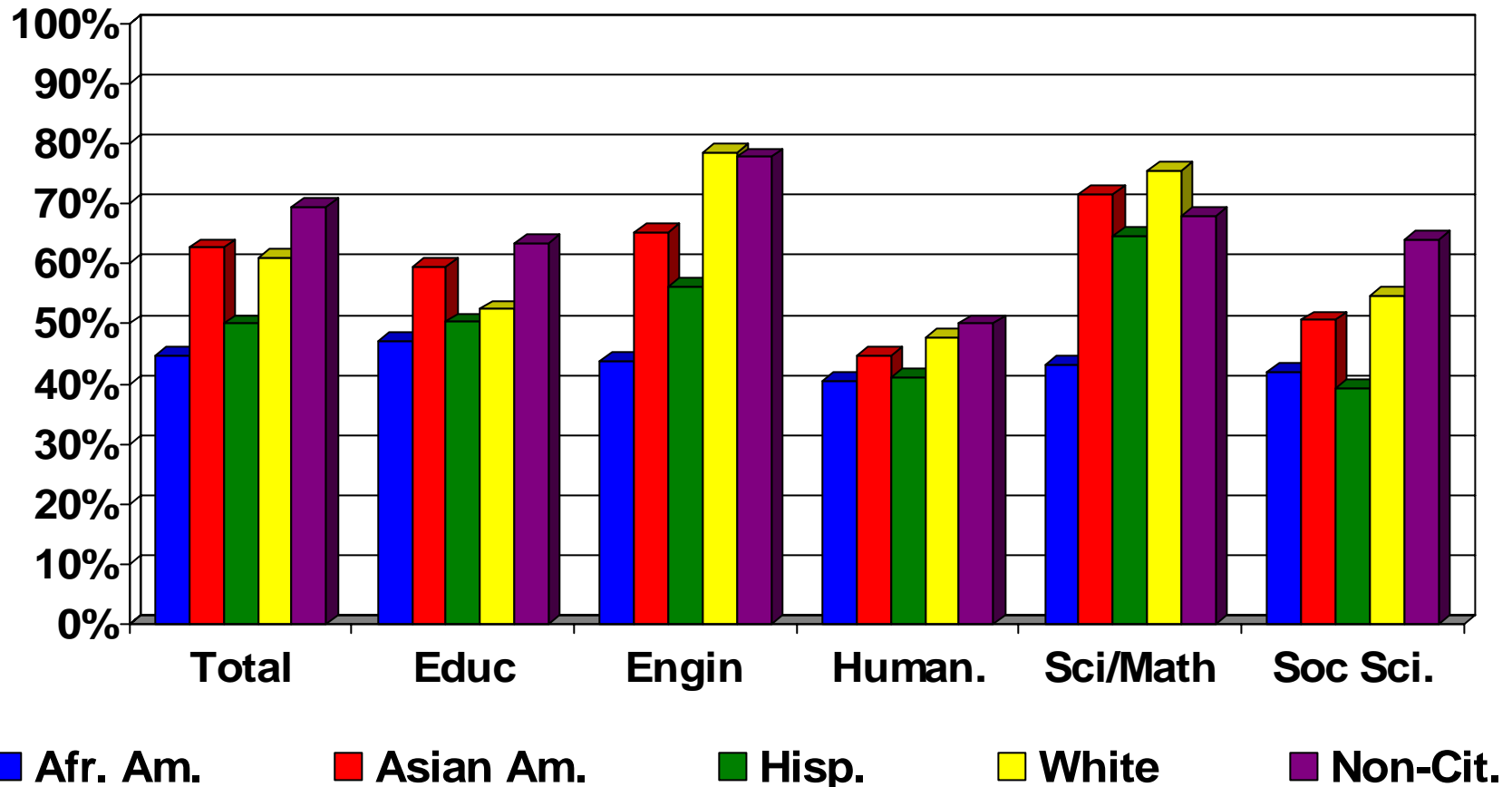


# Pursuit of Ph.D.

- **Persistence/Retention**
- **Progression and**
- **Completion**

# A Snapshot in Time: Doctoral Degree Completion by 2001 for Students Beyond the First Year

- African American & Hispanic students degree completion rates are significantly different from White students in the total.
- Hispanic students differ from White students in engineering.
- Afri. Amer. students differ from White students in engineering, science & math, & soc sci.



# Completing a Doctoral Degree by 2001

- Research productivity is a positive contributor in every field.
- Being married/partner positively influences completion in engineering and science/math.
- Hispanic and African American students differ from White students in engineering.

	Educ.	Engin.	Human.	Sci./Math	Soc. Sci
Male					
African-American		-			
Hispanic-American		-			-
Asian-American		-		-	
International					+
Married/ Partner	+	+		+	
Always full-time	+		+	+	+
Teaching assistant	+		+		
Research assistant				+	
Has a mentor	+	+			+
First job fac./postdoc	+			+	+
Research productivity	+	+	+	+	+

Negative signs = less likely to have completed their doctoral degrees.

Positive signs = more likely to have completed their doctoral degrees.

# What did we learn? Difficult Challenges

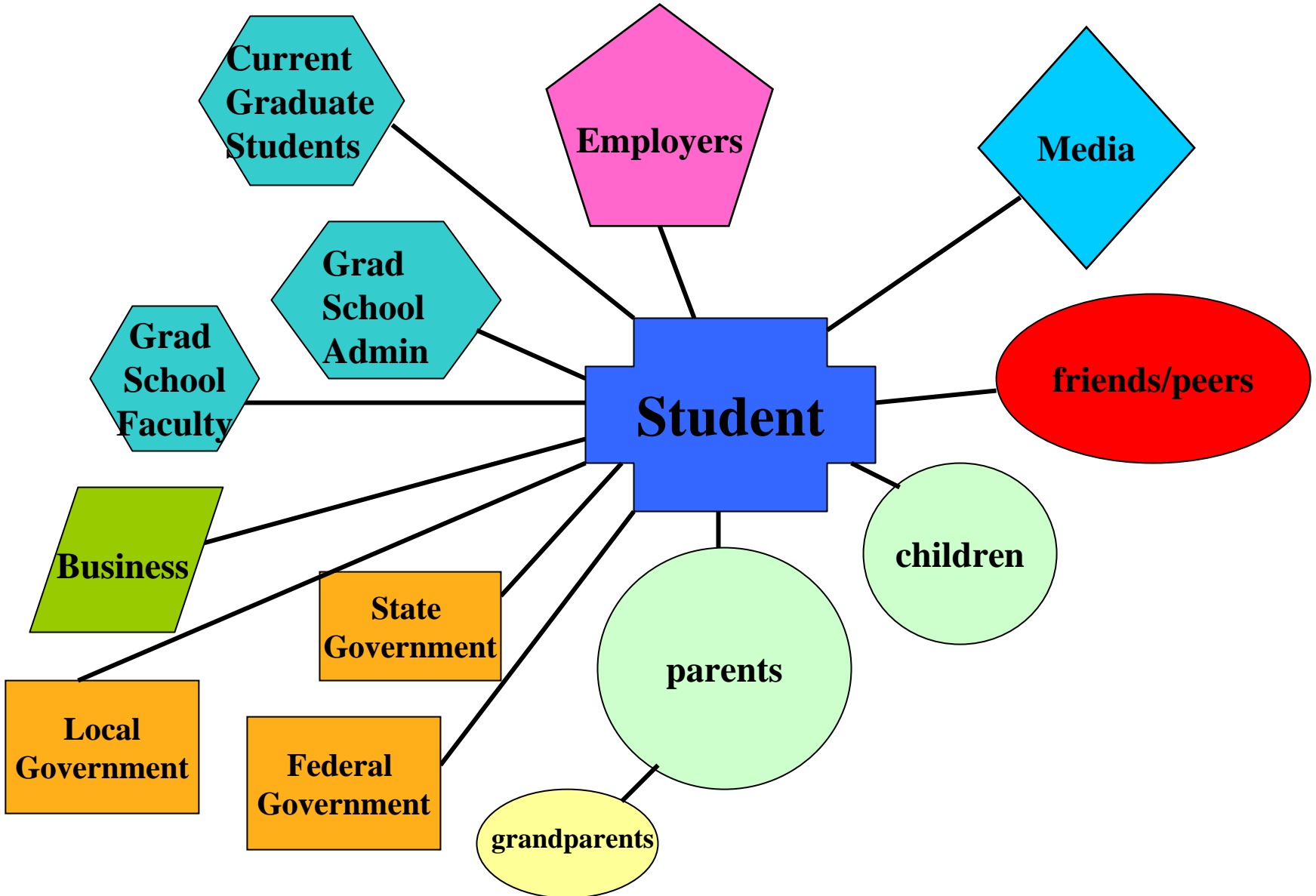
## Controlling for Background, Preparation and Other Program Experiences Differences Exist:

- **Hispanic Student and White Student Differences:**
  - Hispanic students in education were less likely to be RAs compared to White students.
  - Hispanic students in social sciences were less likely to write refereed journal articles compared to White students.
  - Hispanic students in **engineering** and the social sciences were less likely to have completed their degrees by 2001 compared to White students.
- **African American Student and White Student Differences:**
  - African American students in education, **engineering**, and sciences and mathematics were less likely to be RAs compared to White students.
  - African American students in science and mathematics were less likely to have a mentor compared to White students.
  - African American students in education, sciences and mathematics, and social sciences were less likely to write refereed journal articles compared to White students.
  - African American students in **engineering** were less likely to have completed their doctoral degrees by 2001 compared to White students.

# Questions for AAAS/NSF/AGEP and the Nation

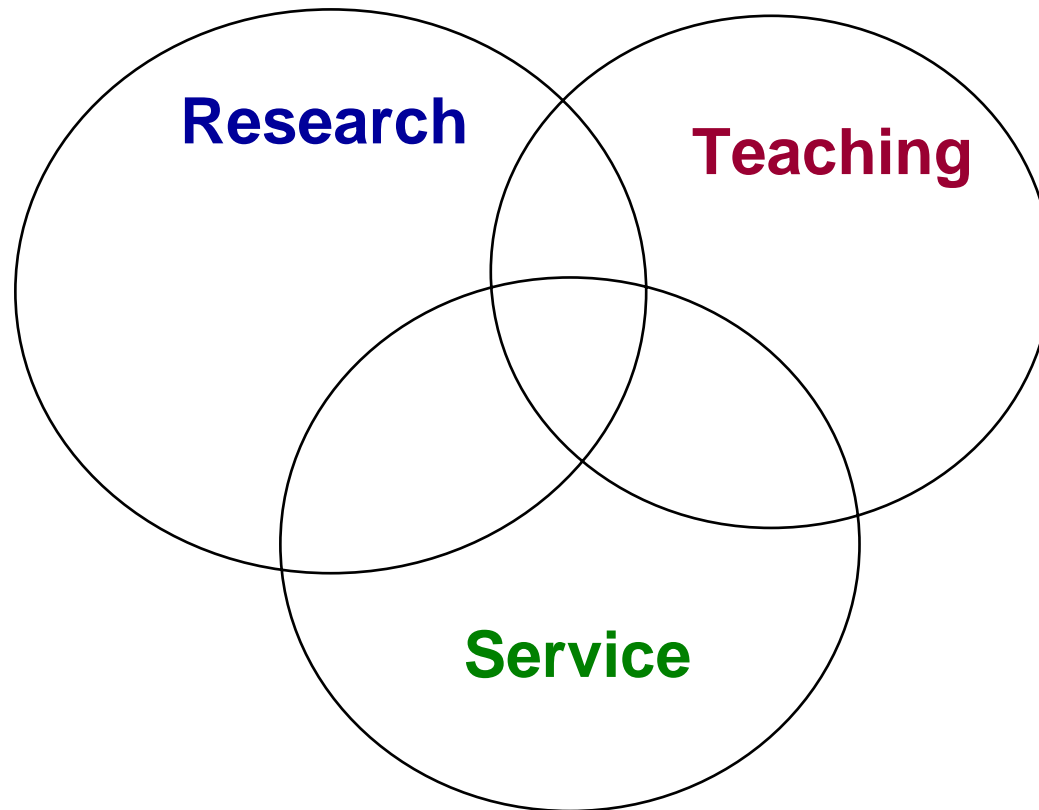
- What experiences should all engineering graduate students have?
- What broad skill sets should graduates have and be able to use?
- How well do we understand what entering graduate students expect from their graduate programs?
- How can we exploit the differences they bring to improve their graduate experience?

# A Doctoral Student's World



# The Holy Trinity

What is the role today?  
What should the balance be?



# Academic & Intellectual Challenges

- Faculty Advisor Issues:
  - Unexpected faculty departures
    - Sabbatical
    - Junior faculty member who is not tenured
    - Death of mentor
  - Conflicts with mentor (holding up dissertation, intellectual property).
- Academic Issues
  - Difficulty in making the transition to independent scholar
  - Loss of confidence
  - Lose interest in dissertation topic
  - Change academic interests and current program does not meet their needs.



# The Influence of Life on One's Graduate Career

- Family Issues:
  - Birth of a child
  - Death of a family member
  - Personal health
- Career opportunities:
  - Work at jobs
  - Fellowships
  - Travel
- Needed a break from school

"Being a graduate student is like becoming all of the Seven Dwarves.

In the beginning you're Dopey and Bashful.

In the middle, you are usually sick (Sneezy), tired (Sleepy), and irritable (Grumpy).

But at the end, they call you Doc, and then you're Happy."

– Ronald T. Azuma



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