

RETENTION IN SCIENCE: THE KEYS TO SUCCESS OF PUI, HBCU AND WOMEN'S COLLEGES

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Why So Few?

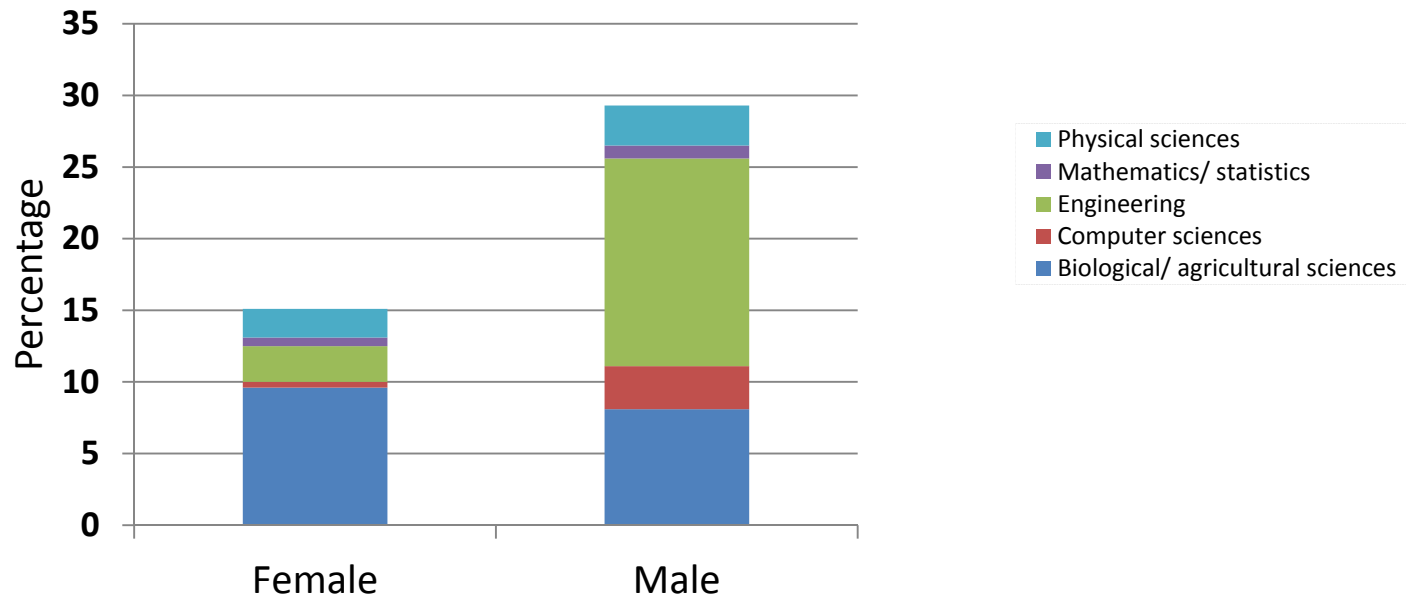
- High School girls participation in science and math has improved over time and surpassed boys in some areas:
 - Girls earn more science credits
 - Girls have better math and science grades on average
 - Girls are more likely to take biology, chemistry and pre-calculus

AAUW Study, 2010



Why So Few?

Intent of First-Year College Students to Major in Science and Engineering Fields, by Gender, 2006



Source: Commission on Professionals in Science and Technology. Data derived from Cooperative Institutional Research Program, Higher Education Research Institute, Graduate School of Education and Information Studies, University of California, Los Angeles, *The American Freshman: National Norms for Fall 1990 through Fall 2006*, www.gseis.ucla.edu/heri/heri.htm.

For the majority of college women and men, interest in science declines during their college years

**“...nearly every gender
difference observed at college
entry widens over time.”**

Linda Sax, *The Gender Gap in College*, 2008,
Astin, 1993



Why so few?

- 77% say women and underrepresented minorities are missing from the workforce because they are not encouraged to pursue STEM studies early
- Stereotypes – STEM is not for women and minorities – portrayed in the workforce and in families, particularly first-generation

Bayer Corporation, March 2010



And more bad news...

- Half of the African American men and Hispanic women say they were discouraged from continuing in STEM
- **44% indicated that college professors were responsible for the discouragement**

Why So Few?

- The environment of science departments continues to be unwelcoming for women and minorities (NRC 2006 Report)
- Stereotype threat
- Implicit bias (see test at AAUW website)

Measures of Success

- Introductory course performance measures
 - Knowledge of facts
 - Discourage creativity and team work skills
 - Fail to emphasize broad relevance of science
- Advances in science pedagogy in the last few decades...role of PUIs

Predominantly Undergraduate Institutions

- 1997-2006, 16% of Ph.D.s in STEM earned by candidates with baccalaureate degrees from PUIs
- Oberlin 50 has out produced, by yield, research universities
- 28 in top 50, per capita

Significant Barriers for Women

- Lack of role models
- Lack of mentors
- Lack of confidence; self doubt
- Cost of education
- Sense of isolation
- Perception that science is disconnected from larger societal concerns

“The single most important environmental influence on student development is the peer group.”

Alexander W. Astin, *What Matters in College? Four Critical Years Revisited*, 1993.



Factors Influencing Women to Continue in Science

- Peer influence
- Studying groups (collaboration)
- Women faculty (a positive influencer for men as well!)

Linda Sax, The Gender Gap In College,
2008



Women's College Graduates

- More likely to have
 - Experience with leadership on campus
 - Been encouraged to take leadership roles
 - Been positively influenced by peers
 - Experience with oral presentations

Women's Colleges

- Rated more effective than co-ed institutions for helping students to:
 - Develop as leaders
 - Solve problems and make effective decisions
 - Think analytically
 - Work as part of a team

Women's Colleges

- Rated more effective than co-ed institutions for helping students to:
 - Write and speak effectively
 - Think creatively
 - Develop self-confidence and initiative

Top Producers of Women Ph.D.s

- Five women's colleges on the list of top 50 (raw data by numbers, not percentages, so bias towards larger institutions) – Barnard, Bryn Mawr, Mount Holyoke, Smith and Wellesley (1920-99)
- In sciences, Bryn Mawr, Mount Holyoke, Smith, Wellesley



Historical Perspective

- Graduates of women's colleges at least twice as likely as women from co-ed colleges to be cited in Who's Who of American women
- 1/3 of women Ph.D.s in the sciences came from women's colleges, even though those colleges granted only 15% of baccalaureate degrees (1920-1973)
- Twice as likely to enter medical school

Tidball, 1980 & 1986



Graduates of women's colleges also ended up attending graduate school at significantly higher rates.

53% percent of alumni from women's colleges earned a graduate degree versus 38% of women at other liberal arts colleges and 28% of women who attended public flagships.

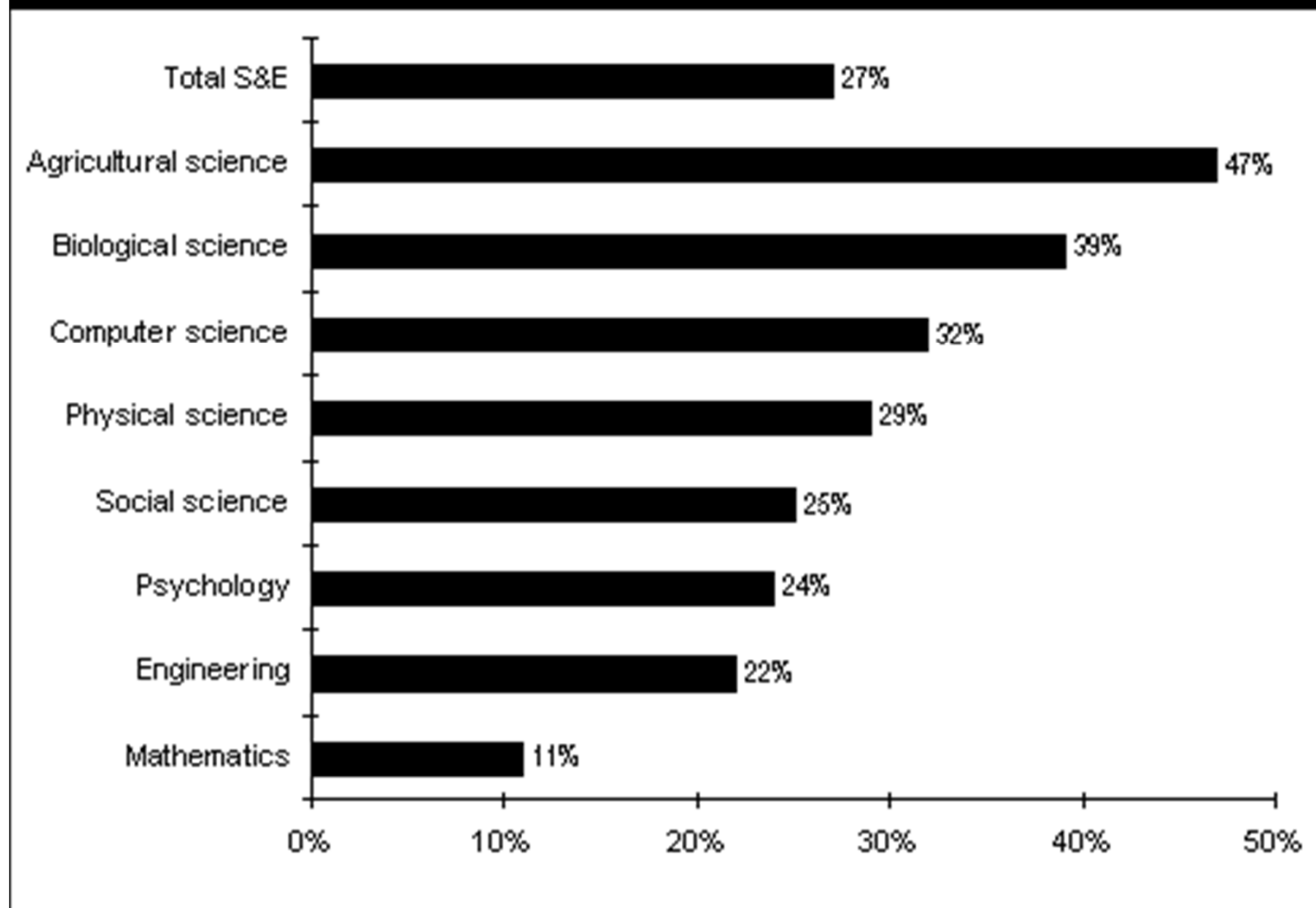
HBCUs

- Only 3 percent of the nation's colleges, they enroll 16 percent of Blacks at the undergraduate level.
- Award nearly 30 percent of all baccalaureate degrees and 20 percent of all first professional degrees to Blacks.
- Nine of the top 10 colleges that graduate Blacks who go on to earn Ph.D.s or medical degrees HBCUs

HBCUs

- 8 out of the top 10 producers of Black graduates in mathematics and statistics are HBCUs.
- Top 12 producers of Black graduates in the physical sciences are all Black colleges, including Xavier University of Louisiana, which is ranked No. 1.

Chart 10. Black U.S.-citizen S&E doctorate recipients with baccalaureate origins in historically black colleges and universities, by broad science and engineering fields



S&E: science and engineering

NOTE: HBCUs are the 90 historically black colleges and universities that award baccalaureates in S&E fields.

SOURCE: National Science Foundation/SRS, Survey of Earned Doctorates for the years 1991-95.

Leading Colleges Black S&E Doctoral Candidates

- Howard
- Spelman
- Hampton
- Florida A&M
- Jackson State University
- Southern University

SOURCE: NSF/NIH/USED/NEH/USDA/NASA, Survey of Earned Doctorates and Doctorate Records File.



Three in four African American females earning the doctorate in the biological sciences had baccalaureate origins in historically black colleges and universities (HBCUs), as did seven in 10 of their counterparts in the physical sciences

Leggon and Pearson, 1997



What Works?

- Connected learning
- Laboratory-rich experiences
- Research experiences
- Multiple assessment strategies
- Faculty/student interaction in close, personal settings

What Works

- Faculty encouragement
- Broad, conceptual based entry courses
- Emphasizing analysis and discussion
- Clear speaking and writing, rather than multiple choice exams
- Emphasis on cooperation rather than competition

What Works

- Students enrolled at an HBCU felt more confident in themselves and in their interactions with faculty because professors looked like them.
- Finding supports prior work that concluded HBCUs promote stronger connections between Black students and faculty (Allen, 1992; Laird et al., 2007).

HERI project: Hurtado, S., et al., June 2009.
Jun 2009



“Effortless Perfection”

- Duke University study ~ women undergraduates felt pressure to be “smart, accomplished, beautiful, and popular” -- all without visible effort
- WISE at Duke developed to mimic women’s college experience (Nan Keohane initiative)

Arizona State University

- WISE Residential Program, offered through the College of Technology and Innovation.
- Provides women majoring in the STEM fields a positive living environment.
- Open to female first-year students as part of the Technology House Residential College.



ASU

“As young people sort out what they want to do in life, seeing someone just a bit further down the path who you can identify with in some way is often helpful in getting to the ‘I can do this, too’ conclusion,” Keith Hielmstad, Vice President and Dean of the College.



UMBC – Meyerhoff Scholars

Summers & Habrowski, 2006

- Scholarships
- Study groups
- Tutoring and counseling
- Peer mentor program
- Group activities
- Receptions with mentors & parents
- Team building events
- Group travel and community building events



UMBC - Meyerhoff Scholars

- Seven-fold increase in African-American UGs in STEM (overall AA enrollment increase 1.4-fold)
- Overall and STEM enrollment of latino students (three- and five-fold respectively)
- Average GPA of African-American S&E grads increased from 2.7 to 3.21 in 7 years

Scripps College

- Founded in 1926 by Ellen Browning Scripps

“The paramount obligation of a college is to develop in its students the ability to think clearly and independently, and the ability to live confidently, courageously, and hopefully.”



As an Example

- Interdisciplinary humanities
- Historical position with respect to other liberal arts and women's colleges
- Recent trend in STEM fields
- Recent success with NSF Graduate Fellowships

The Future

- Women more attracted to faculty positions as PUIs and comprehensive institutions.
- To advance women in science, gender equity must be a concern of all – men and women.
- Women's education will remain important to success!