

Trumping the Gender Imbalance in Computing

J McGrath Cohoon
University of Virginia
National Center for Women in IT



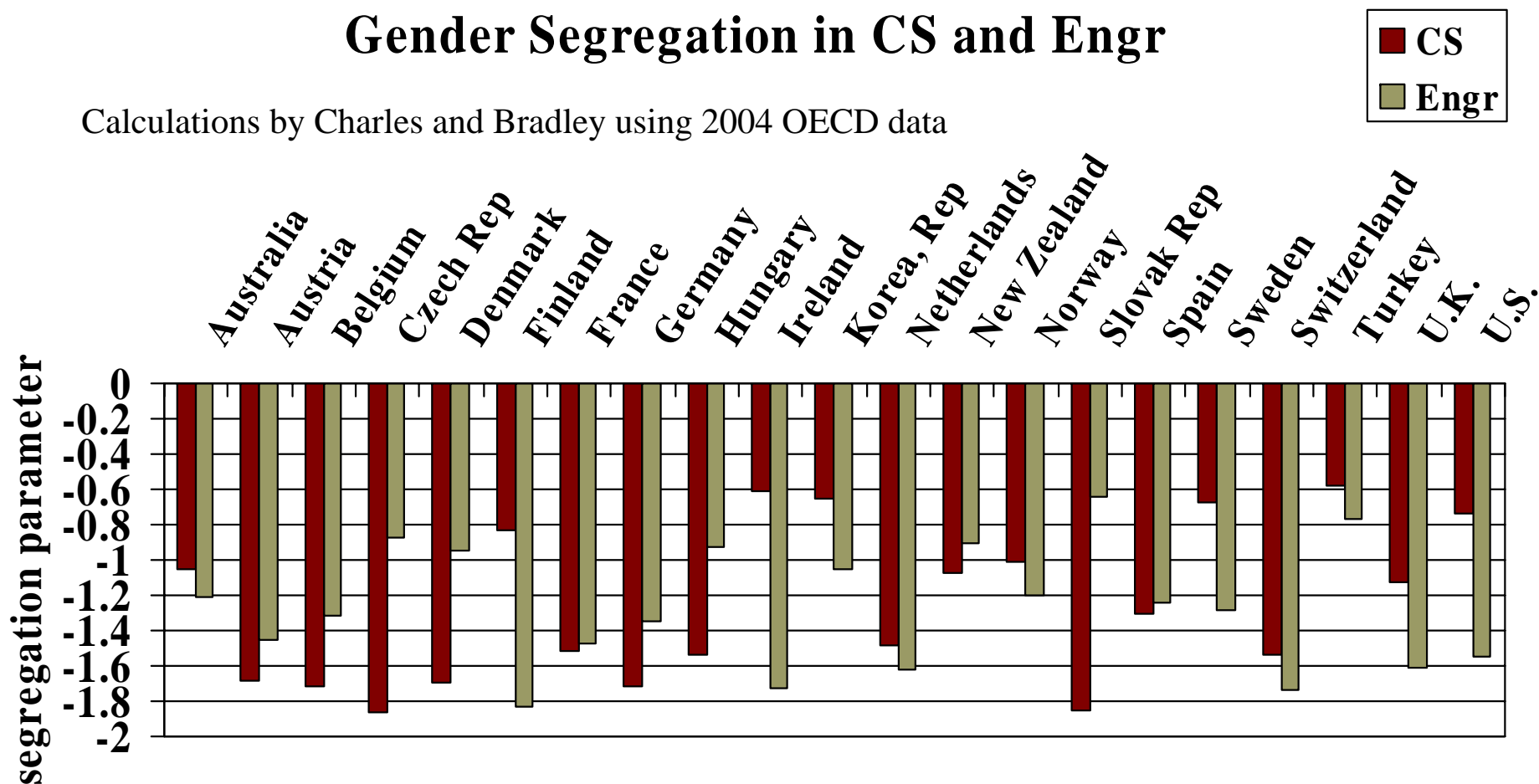
Overview

- The gender imbalance in postsecondary computing
- Few women enter, many leave
- Not the math
- How academic departments affect the gender gap in attrition
- Take Away
 - Women's underrepresentation is not inevitable
 - Support is key

New but Not Improved

Gender Segregation in CS and Engr

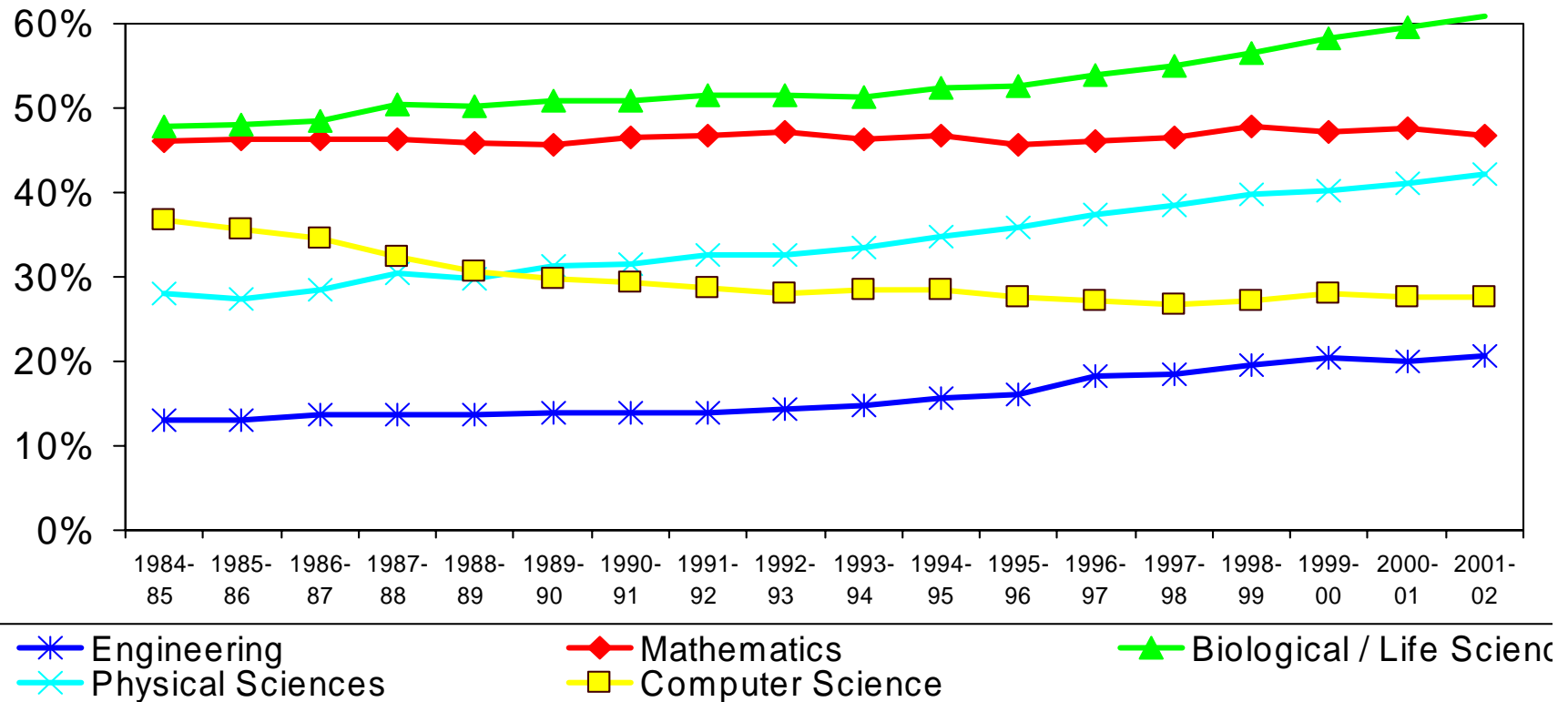
Calculations by Charles and Bradley using 2004 OECD data



Cohon
National Engineers Week

Discipline Comparisons in the U.S.

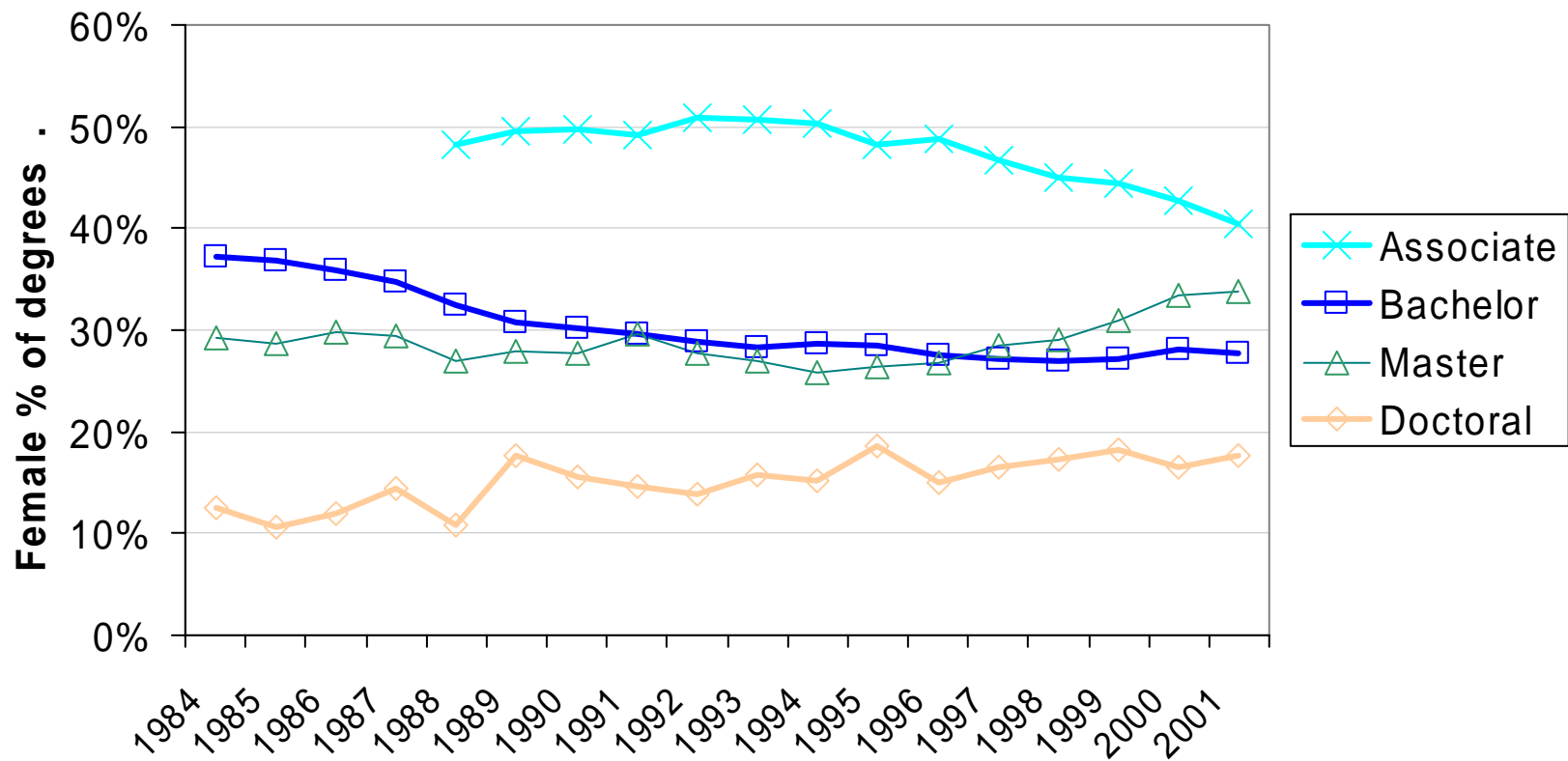
Women's Percent of Baccalaureates, 1985-2002



Cohon
Data source: National Center for Education Statistics, IPEDS data

Low at Each Degree Level

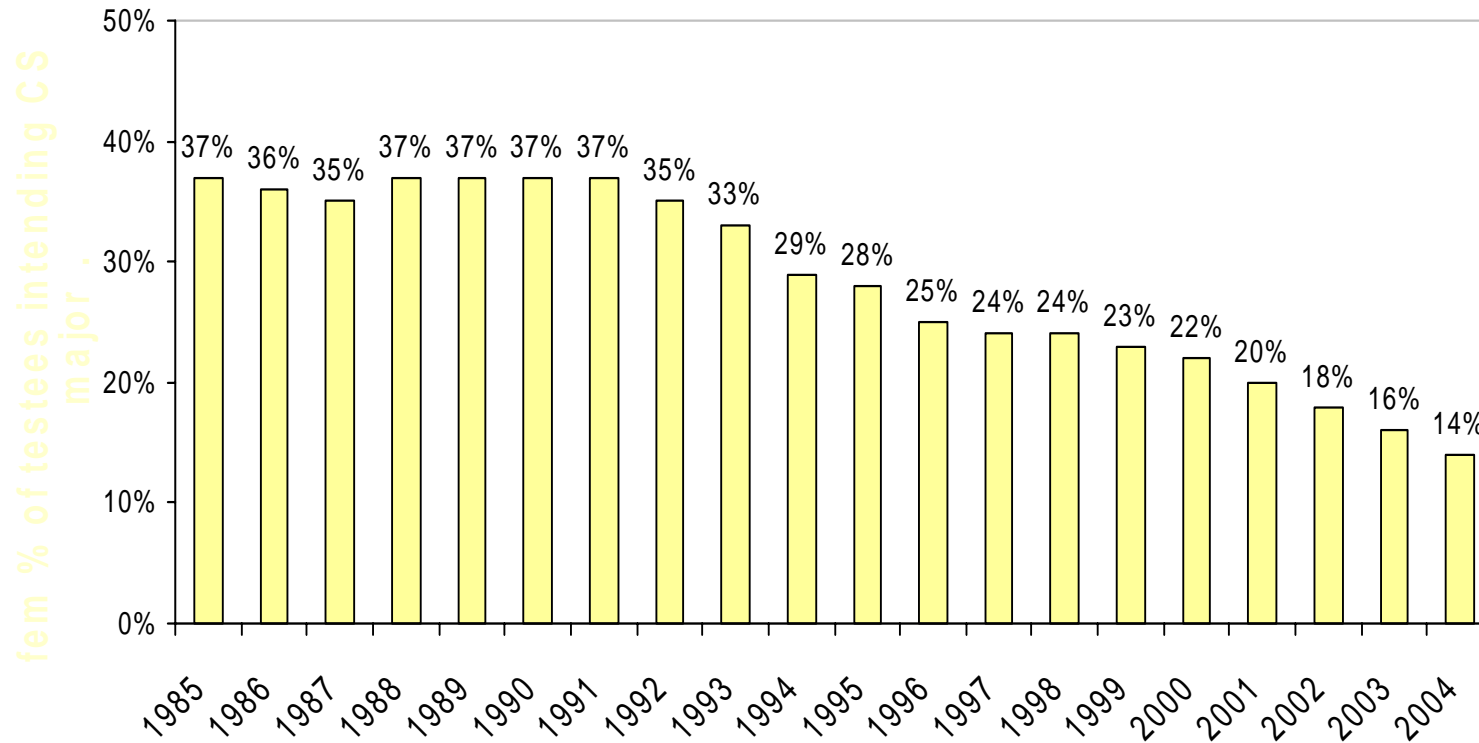
Women in CS Degree Levels



Cohon
National Engineers Week
Data source: IPEDS data

College-Bound CS Students

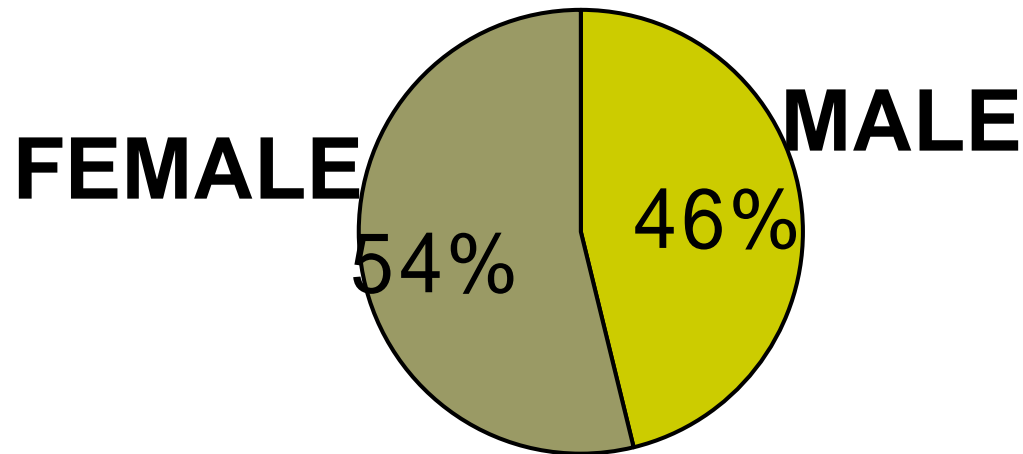
Female Portion of Intended CS Majors



Calculated with data from the College Board
© 2005
National Engineers Week

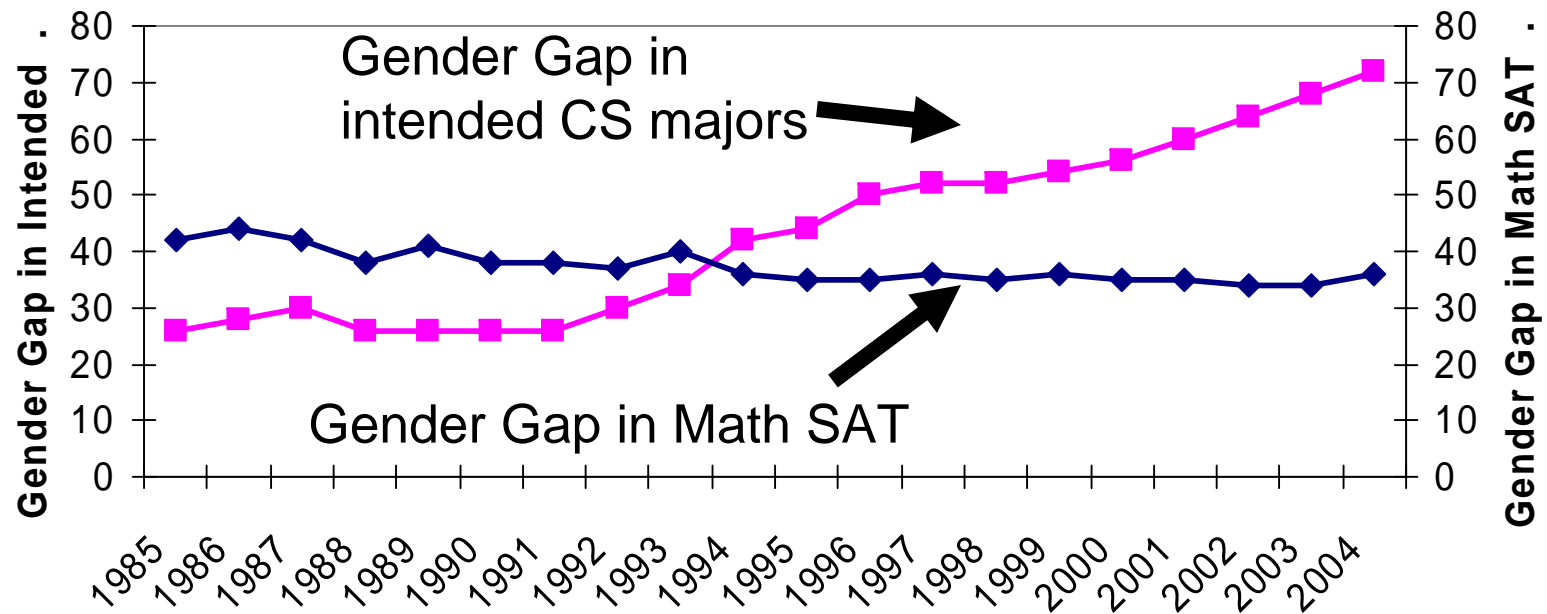
Differences in Math Foundation?

Honors Math Course 2004 SAT-Takers



Mathematics SAT Score?

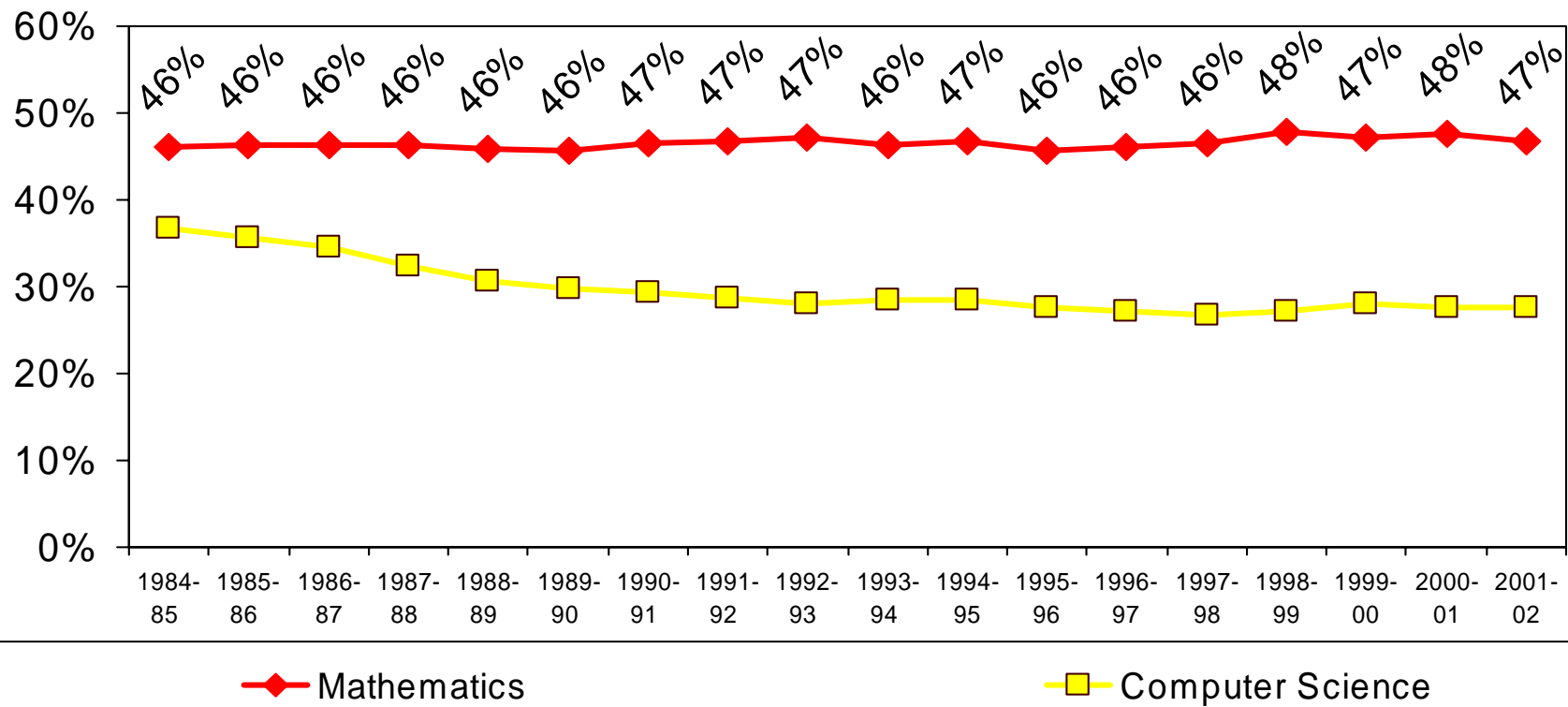
College-Bound Intent and Tested Preparation



Calculated with data from the College Board
© 2005
National Engineers Week

Can't Do the Math?

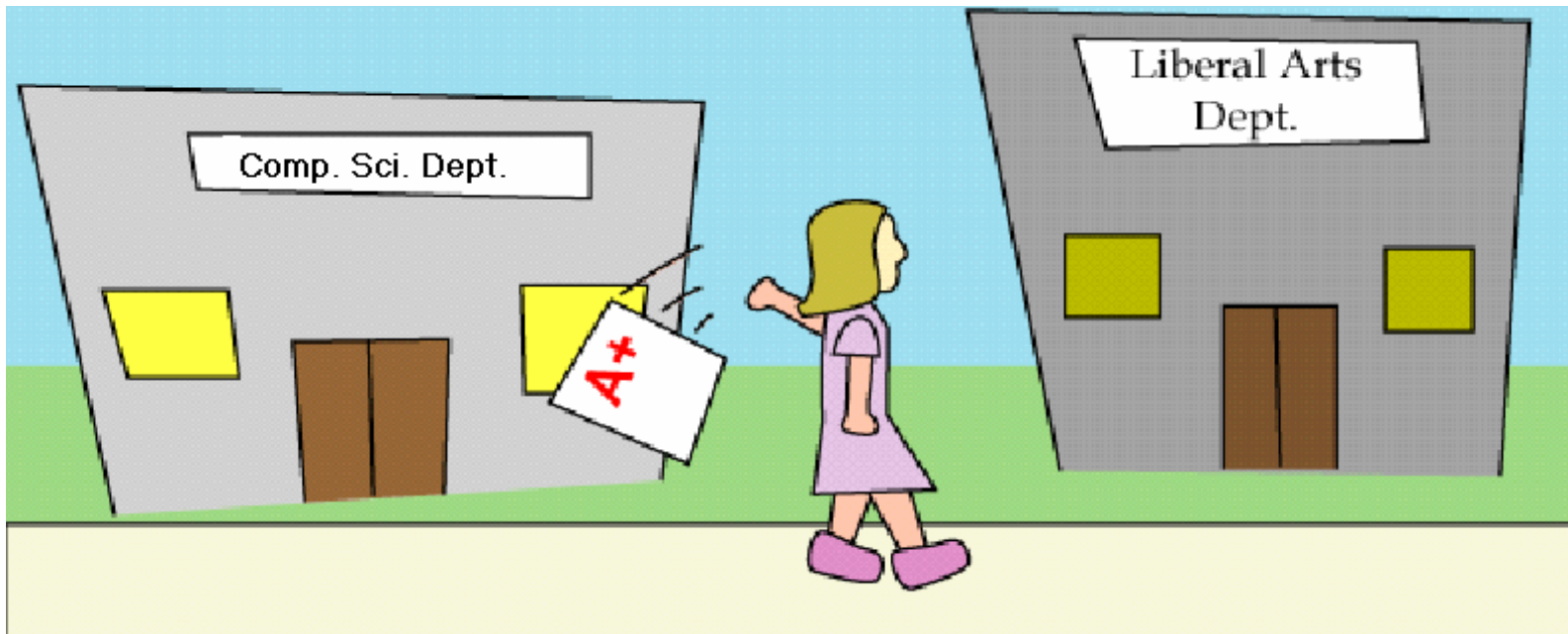
Women's Percent of Baccalaureates, 1985-2001



Cohon
National Engineers' Week
Data source: National Center for Education Statistics, IPEDS data

Able Women Go Elsewhere

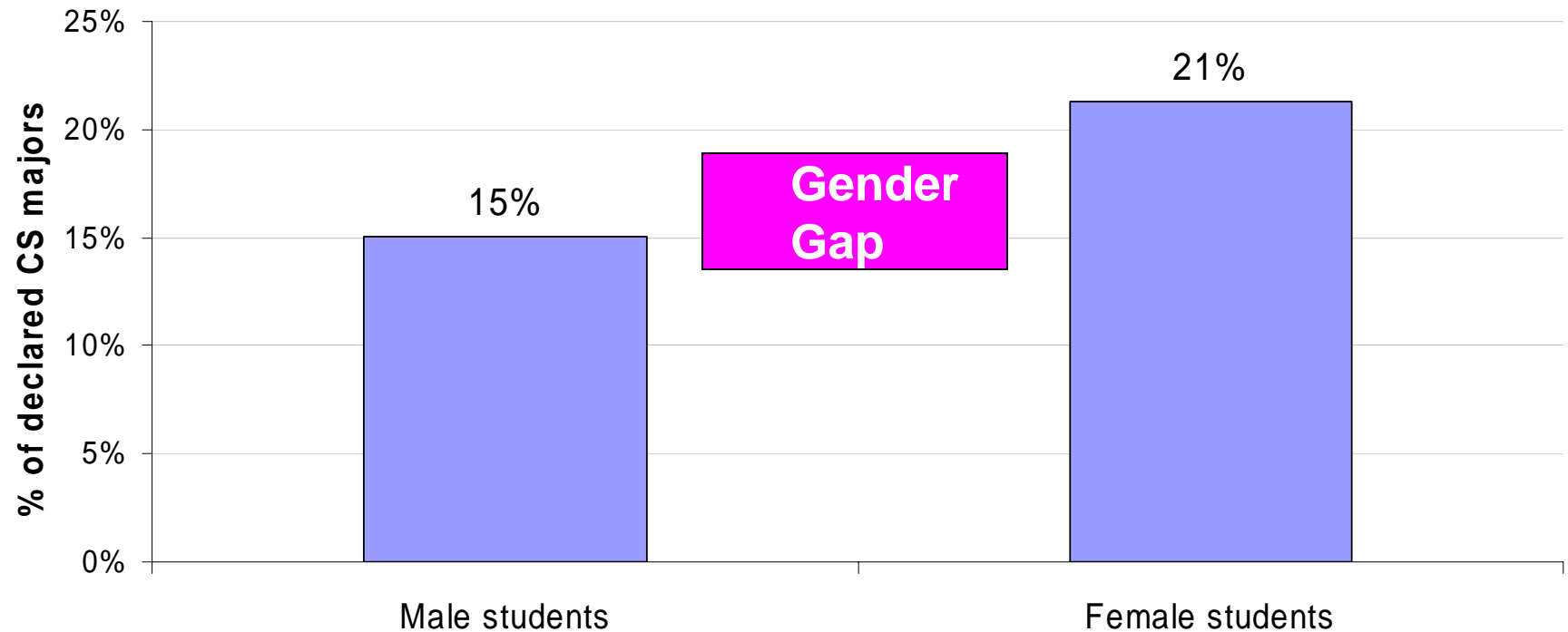
- *She got an A in Computer Science [Intro] in the fall and an A+ in [Calculus I]. And do you know what she's taking this semester? English, Psychology, and Music. - CS Faculty Member*



National Engineers Week

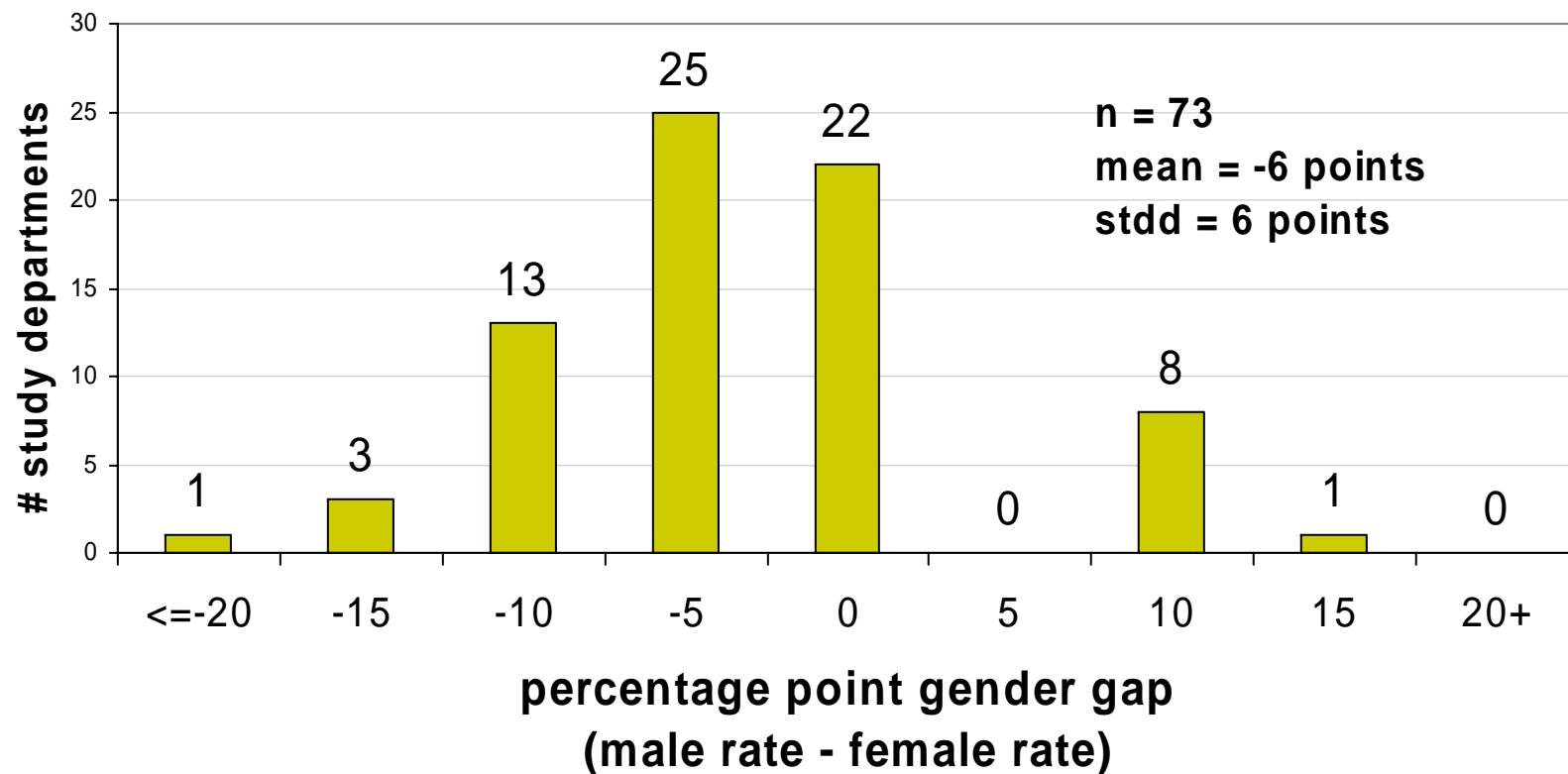
Gendered Attrition from CS

Average Annual Undergraduate Attrition 1994/95 - 1999/00



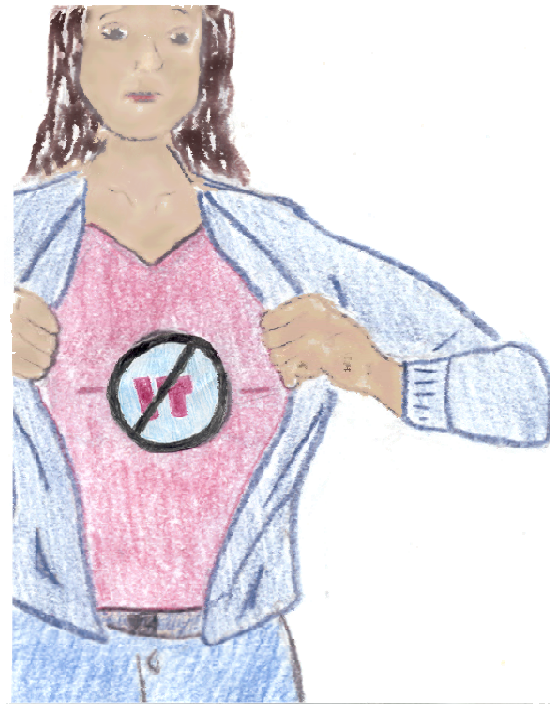
Departmental Variation

Gendered Attrition from the CS Major



Research Question

- What departmental characteristics are associated with the size of the gender gap in undergraduate attrition rates?





Methodology – Pre-Survey

- Pilot study

- Interviews in 2001
 - 18 departments
 - 143 faculty and chair interviews
 - 178 undergraduate CS students



Methodology – Nationwide Survey

- Survey of 209 undergraduate CS departments in 2002
 - Largest and/or most prestigious undergraduate programs
 - Contiguous United States
 - Response rates
 - 76% chairpersons (159 chairs)
 - 68% faculty (1716 faculty)



Methodology – Other Data

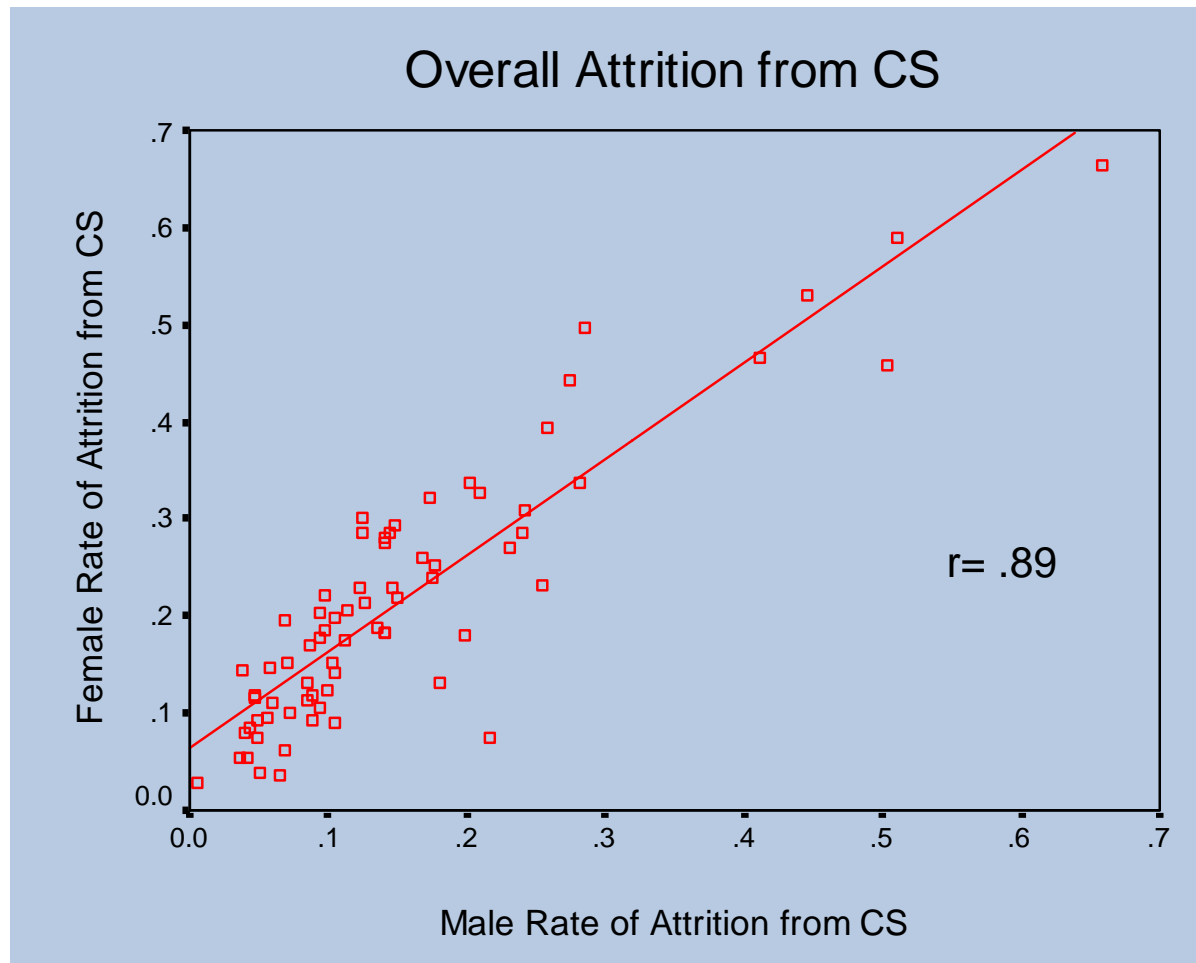
- Official enrollment and disposition data
 - 73 departments
 - Calculate attrition/retention for men and women



How Are Women Retained?

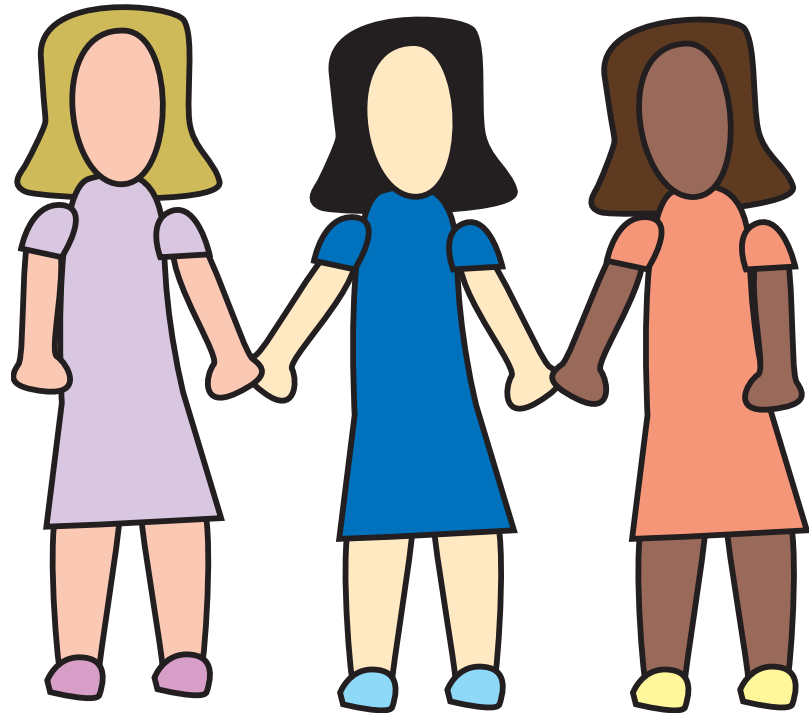
- Same as men for the most part
- Peers
 - Same-sex peer support
- Faculty
 - Encourage
 - Mentor for diversity
 - Expect work and focus
 - Adequate faculty

Leaving Under Same Conditions



Same-Sex Peers Retain Women

- Women help retain women undergraduates



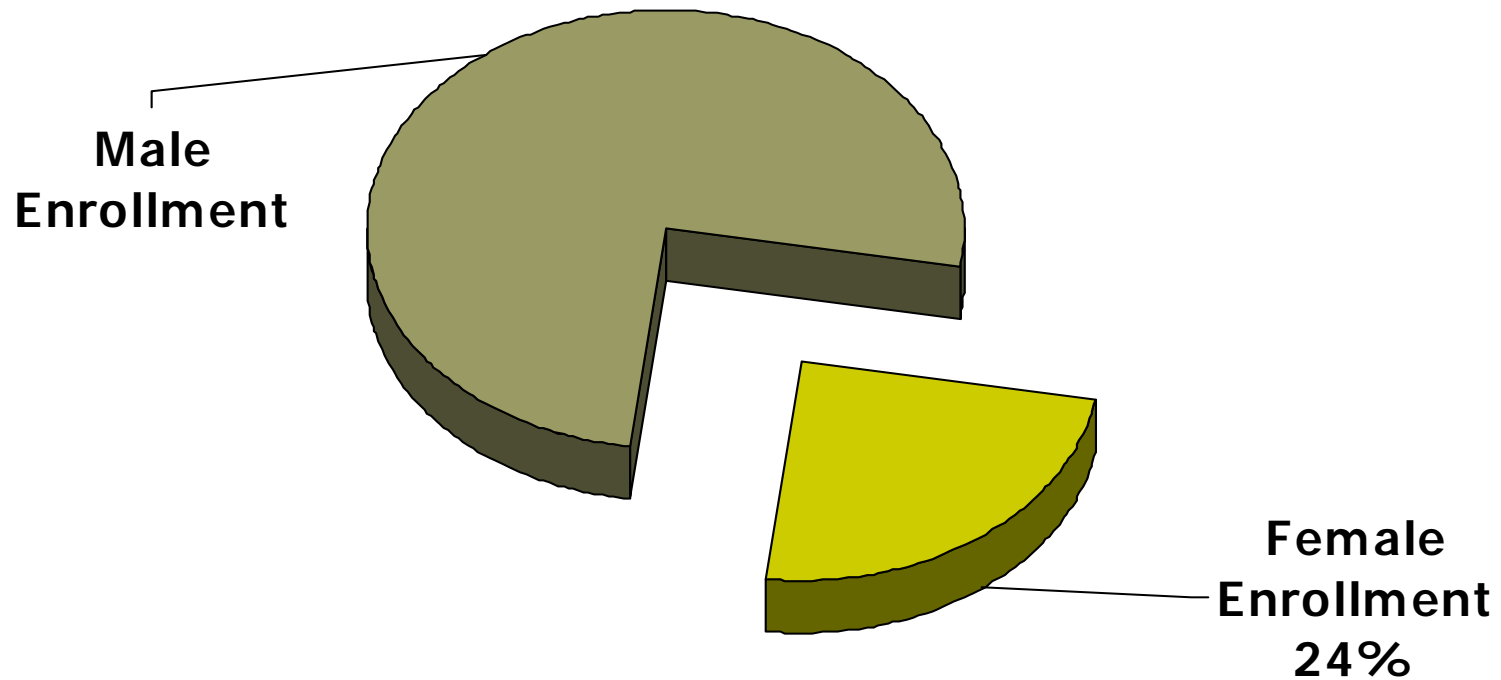


Importance of Peer Support

- Most effective method of coping
 - *If I didn't have people here that I could come to and say, “What does this mean?” I don't think I would have stayed at all. - Female CS Major*
 - *You don't need a professor who's going to be like, ‘Don't you know this information? Didn't I teach it to you last week?’ You need a friend who says, ‘Don't worry. Together we'll work at it, and we'll learn it.’ - Male CS Major*

Few Female Classmates

Gender Composition of Average Study Department





Why Same Sex?

- Many women in CS comfortably rely on men
 - *I've always, ever since I was tiny, had guys for friends. ... You know - I'm getting married; I can't seem to find any bridesmaids.*
 - *My brother's my maid of honor.*
 - **Female CS Majors in the same focus group**

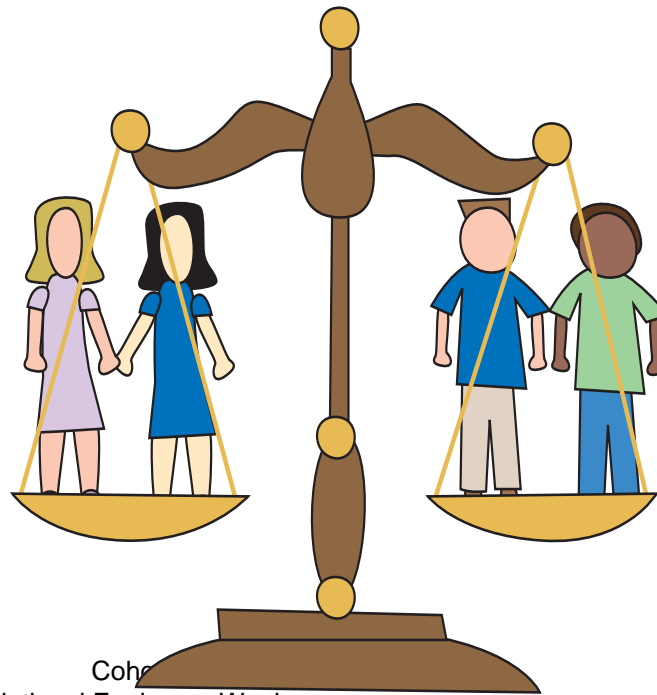


Why Same Sex?

- Some women prefer to rely on women
 - Easier to approach
 - Less concern about image
 - Less opportunity for misinterpretation
- Classmate support from men?
 - *I got a 4.0 in my first semester and I had at least three separate guys, upon hearing about it, ask me if I did “special favors” for the professors. - Female CS major*

Equal Access to Peer Support

- Gender balanced enrollments give women and men equal access to peer support



Coh
National Engineers Week

Faculty Help Retain Women

- ❑ Sufficient faculty
- ❑ Supportive faculty
- ❑ Mentoring
- ❑ Expect effort and academic focus



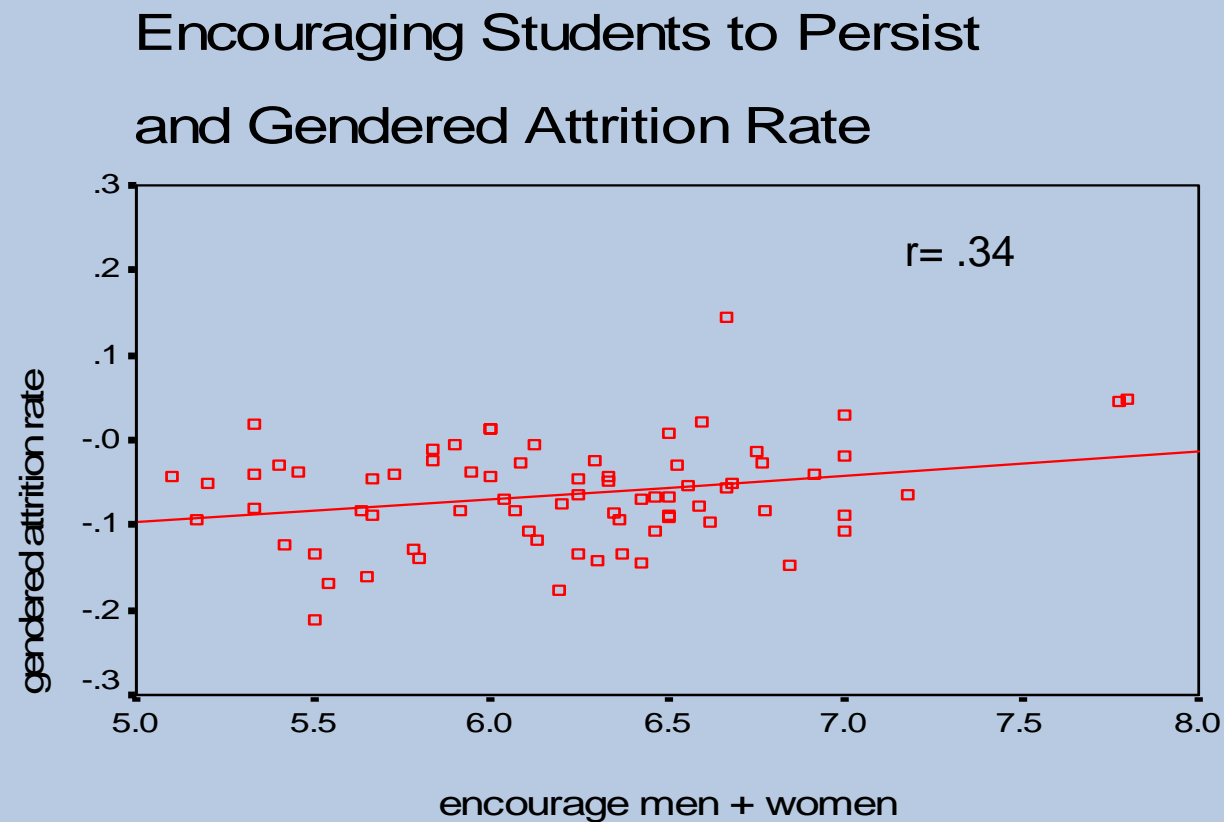


Supportive Faculty Retain Women

- Encouraging students

- *It just takes me going to them and saying, "You do better than you think you do, so keep trying." - Male CS Faculty Member*

Encouraging Students to Persist





Mentoring Undergraduates

- Out-of-class relationship that includes
 - Involving individual students in professional activities
 - Offering personalized advice
 - Encouraging individual students
 - Helping students establish careers



Typical Mentoring

- 3 hours/week for undergraduates
- 3 hours/week for graduates
- 25% of faculty mentor to overcome underrepresentation
- 23% of faculty initiate mentoring

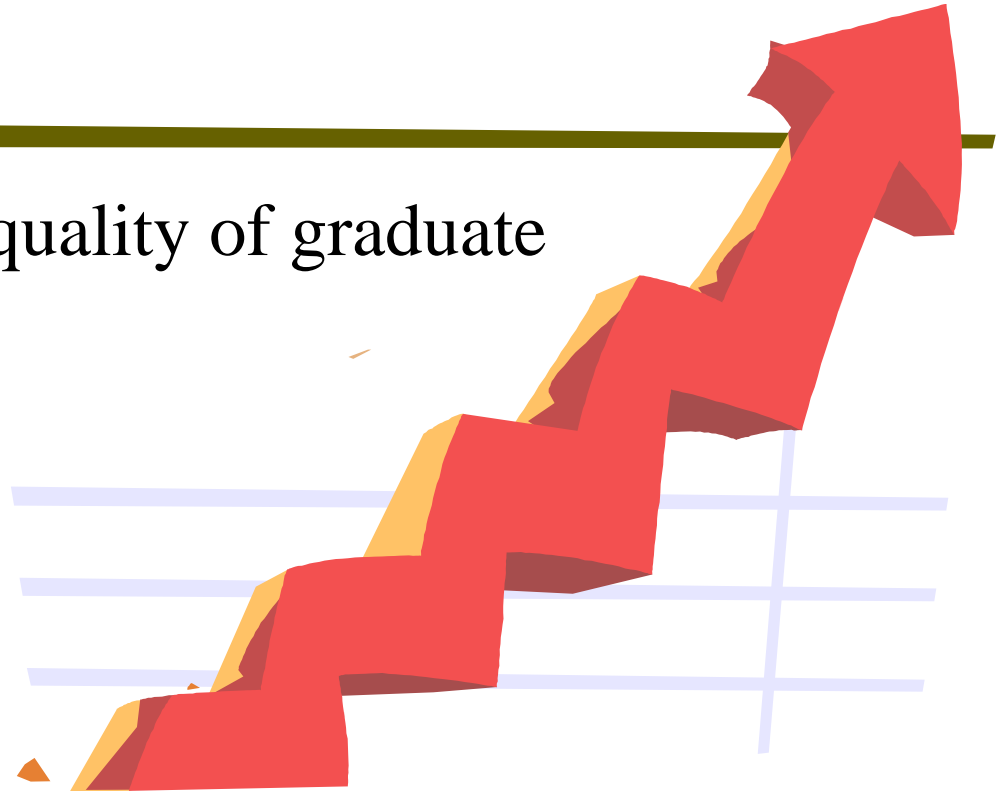


Two Types of Mentoring

- Support mentoring
 - Help navigate rules
 - Encourage shy but competent students
 - Specific positive feedback
- Research mentoring
 - Involve students in research
 - Publish with students
 - Inform students of research opportunities
 - Supervise non-course-related work

Advancing Students

- Support mentoring ↑ progression to graduate study
- Research mentoring ↑ quality of graduate program

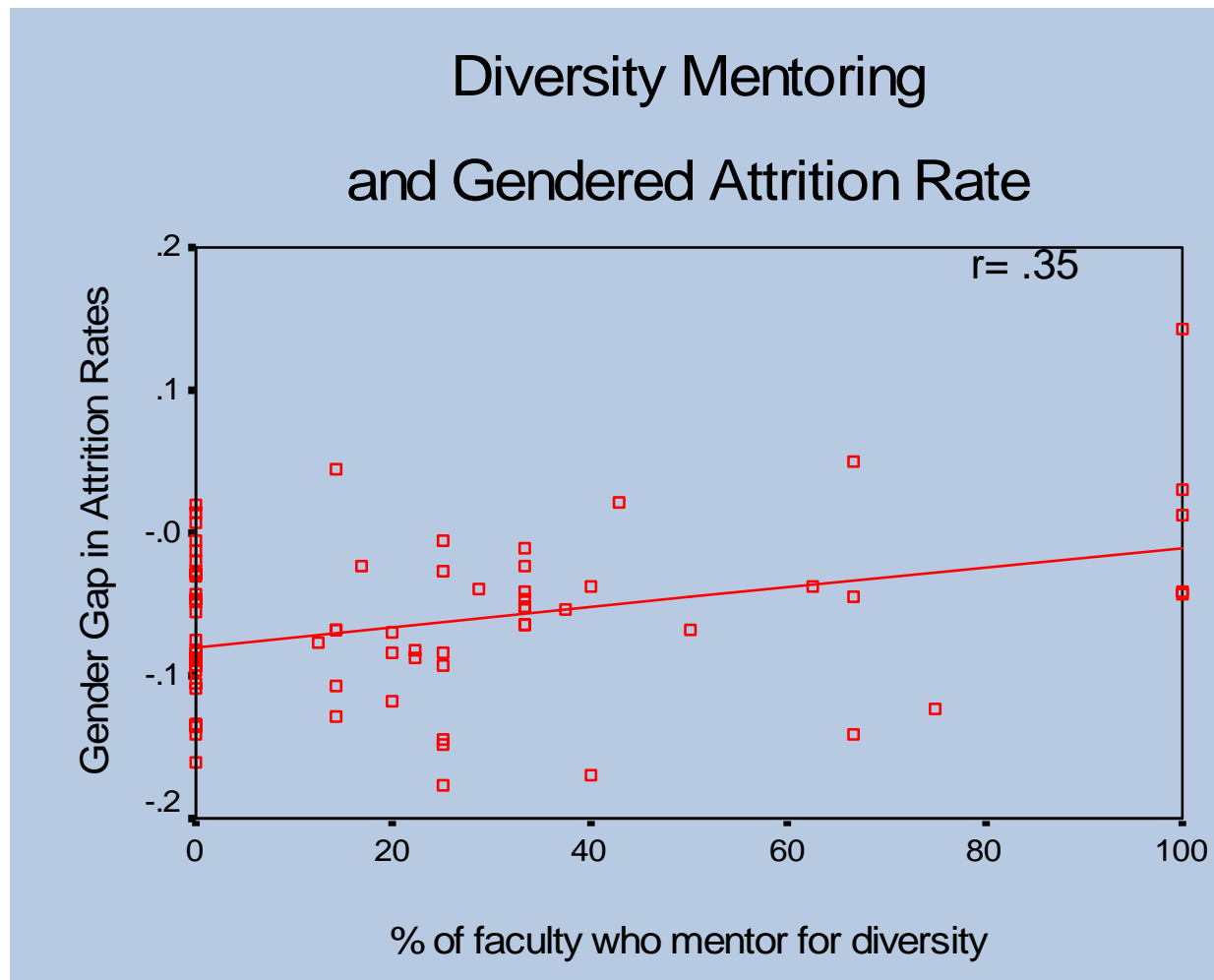




Outcomes of Mentoring

- Advance to graduate study
- Retain women through diversity mentoring

Mentoring for Diversity





Diversity Mentoring Retains Women

In the beginning, I was having such a hard time ... with the class itself. And for me, [Professor X] was encouraging because she was, "Just keep at it. You can do it. We need more women in the field." [Laughter from other members of the focus group.] And, yeah. You're laughing, but it's true. It made me feel better.

- Woman CS Major



Hard Work and Academic Focus

- Undergraduate women succeed when faculty
 - Emphasize homework (average 7 hrs/week/course)
 - Expect academic focus

***I was in a sorority,
but I quit that
because it was too
much time
commitment. ...
I'm really trying to
focus on school. –
Woman CS Major***



Explaining Gendered Attrition

- Adjusted $R^2 = .46$ for undergraduates
 - Concern over insufficient faculty
 - Faculty who encourage
 - Faculty expect academic focus
 - Mentor for diversity
 - Female percent of enrollment
 - Hours of homework



So What Do We Know?

- Generalizable results about retaining women

- Generalizable results about advancing students
 - Clues about advancing women



Implications

- Gender balance can be improved
 - Local environment can overcome inherent differences and prevailing stereotypes

- Opportunity for intervention



Ingredients for Success (Best, 2004)

1. Institutional leadership and commitment
2. Recruit and advance
3. Faculty who are engaged and supportive
4. Individual attention
5. Peer support
6. Financially facilitate an academic focus
7. Research early for research later
8. Measure outcomes



More Information

- <http://curry.edschool.virginia.edu/ITattrit>

- Acknowledgement and Disclaimer
 - This material is based upon work supported by the National Science Foundation under grants numbered EIA0089959 and . Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation

 - Special thanks to all those who provided data for this study