Stop
The Female Brain Drain

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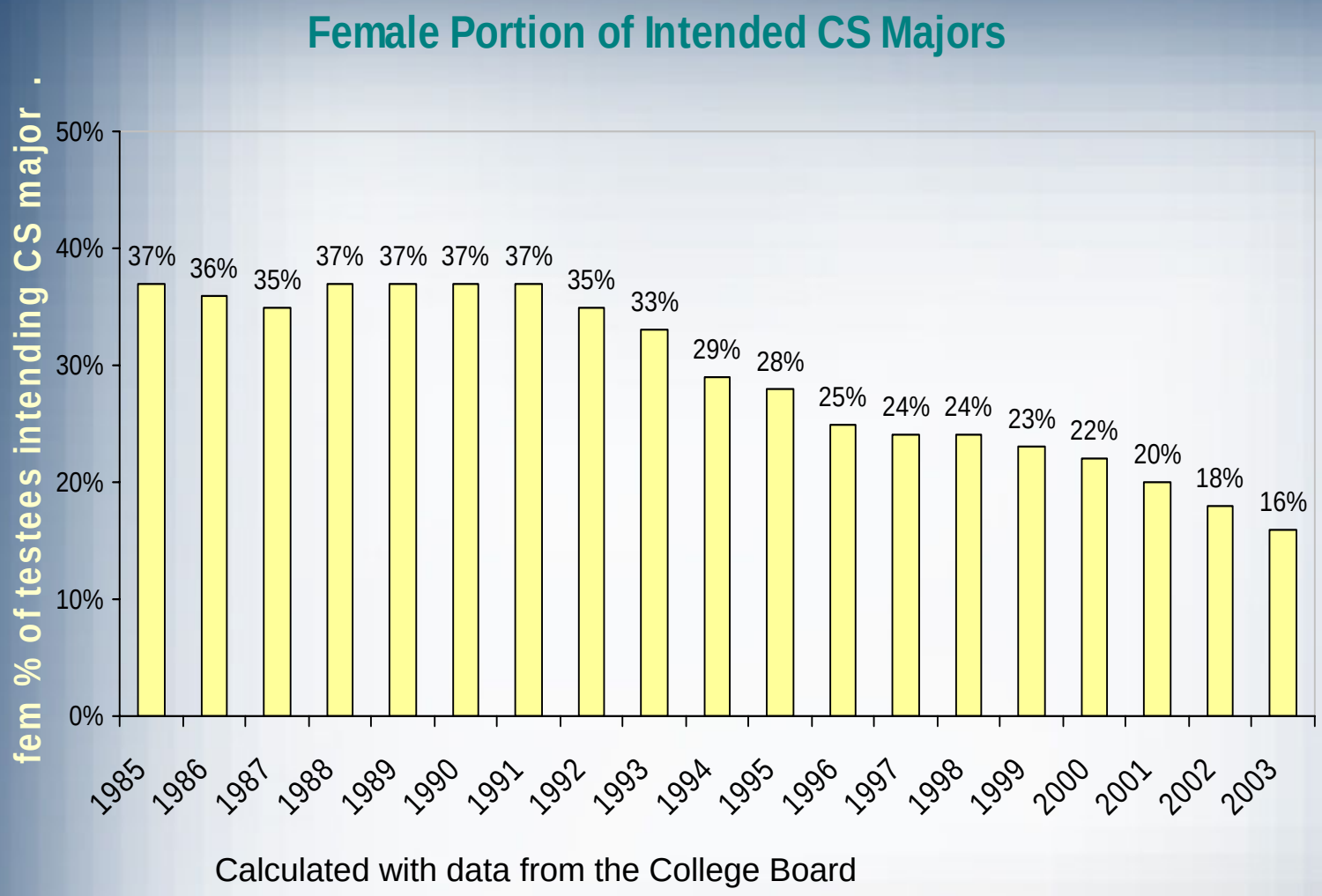
Overview

- Gender imbalance
- CS departments contribute
- Implications

Should We Pay Attention to Gender?

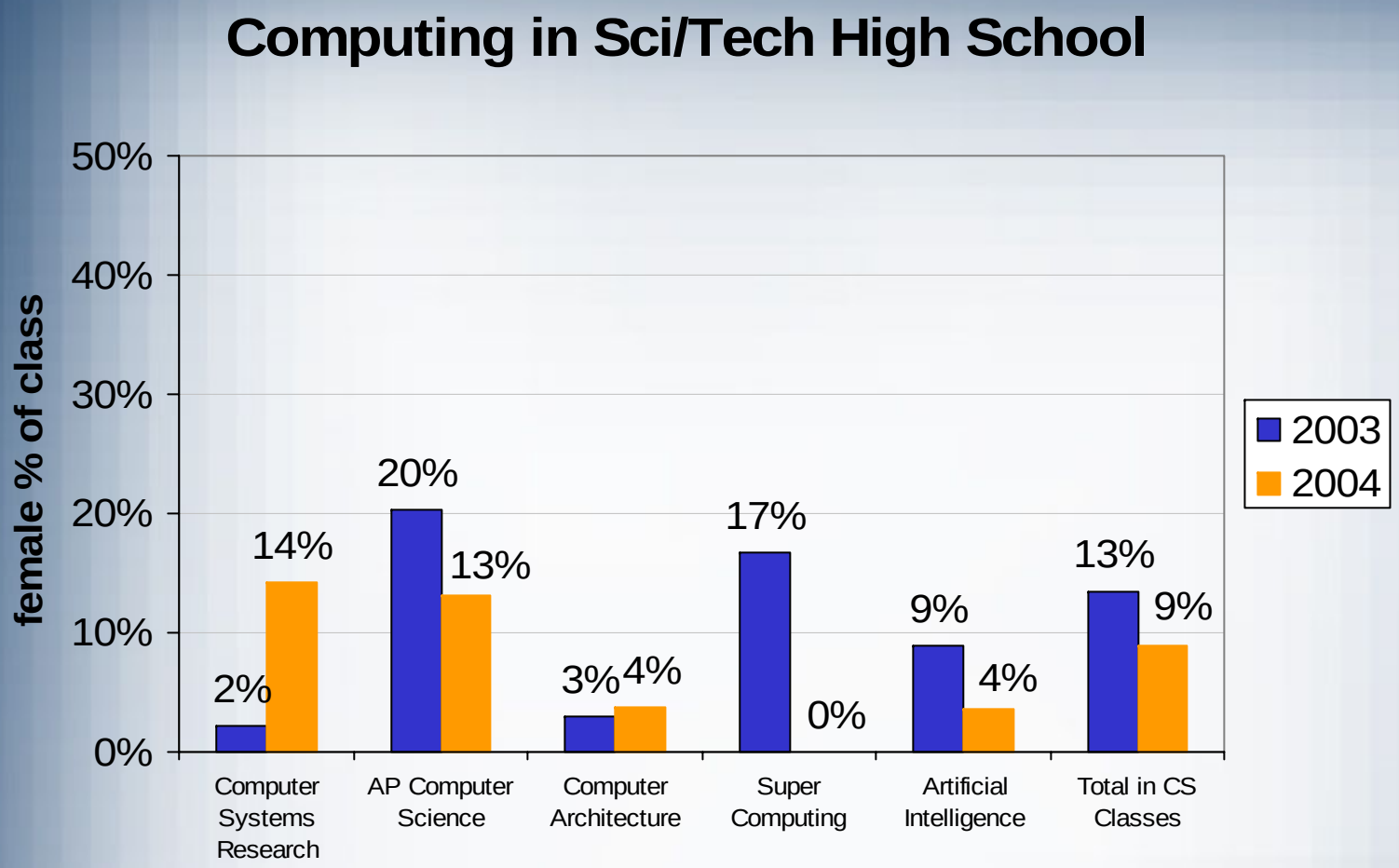
- MicroSoft TechEd 2004 and Computing Curriculum Workshop

College-Bound CS Students

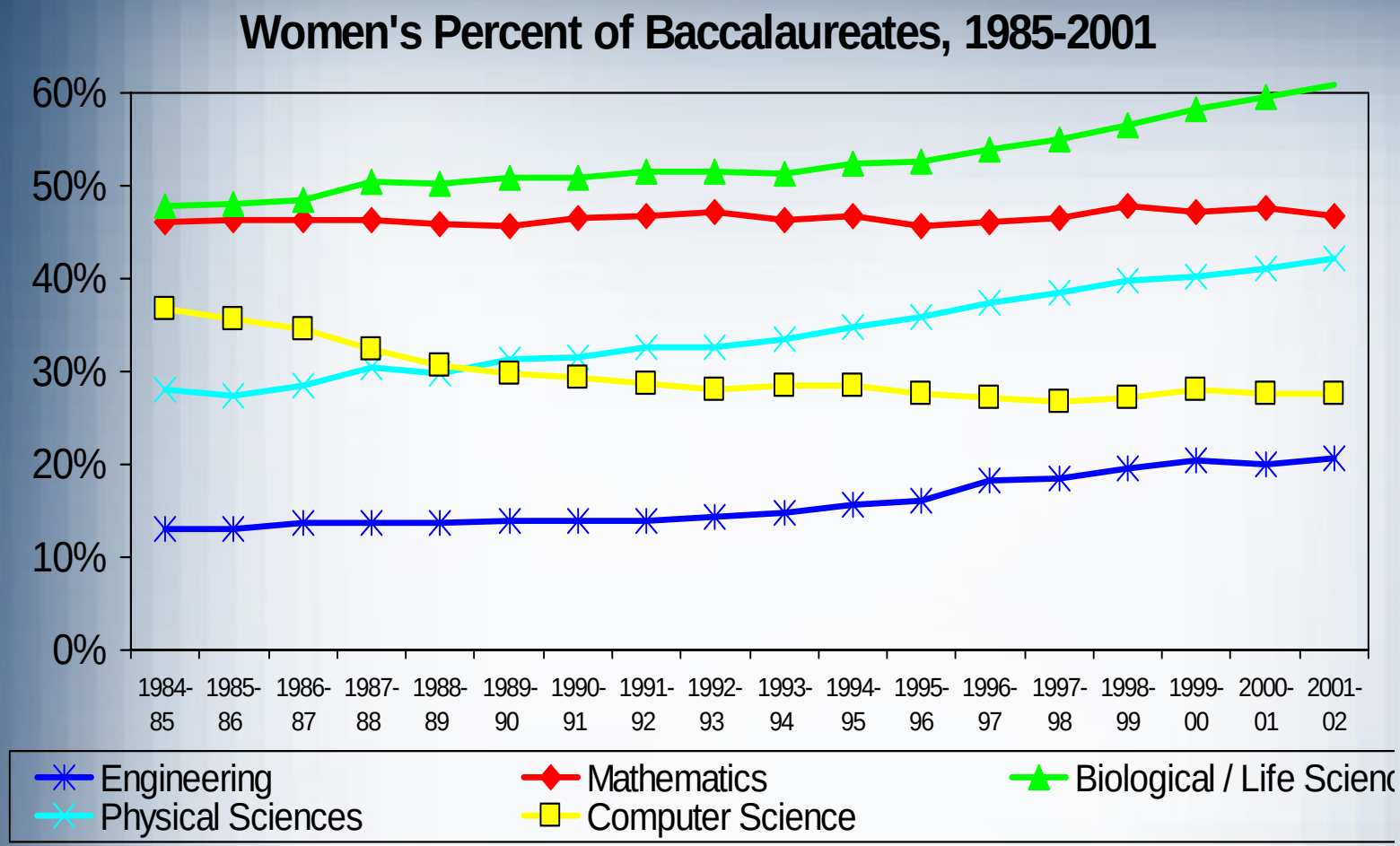


Calculated with data from the College Board

Science & Technology High School

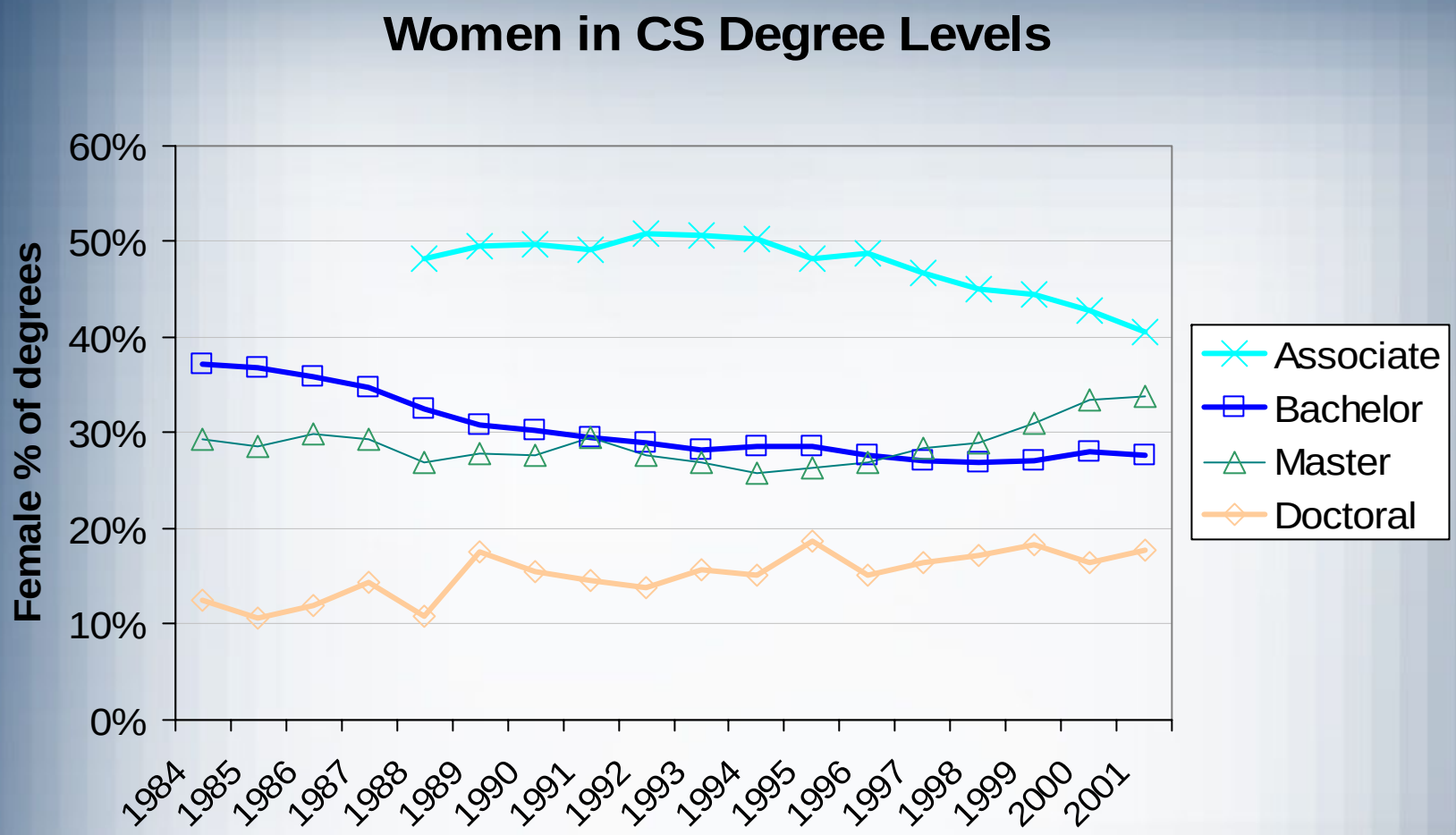


CS Bucks The Trend



Data source: National Center for Education Statistics, IPEDS data

Low at Each Degree Level



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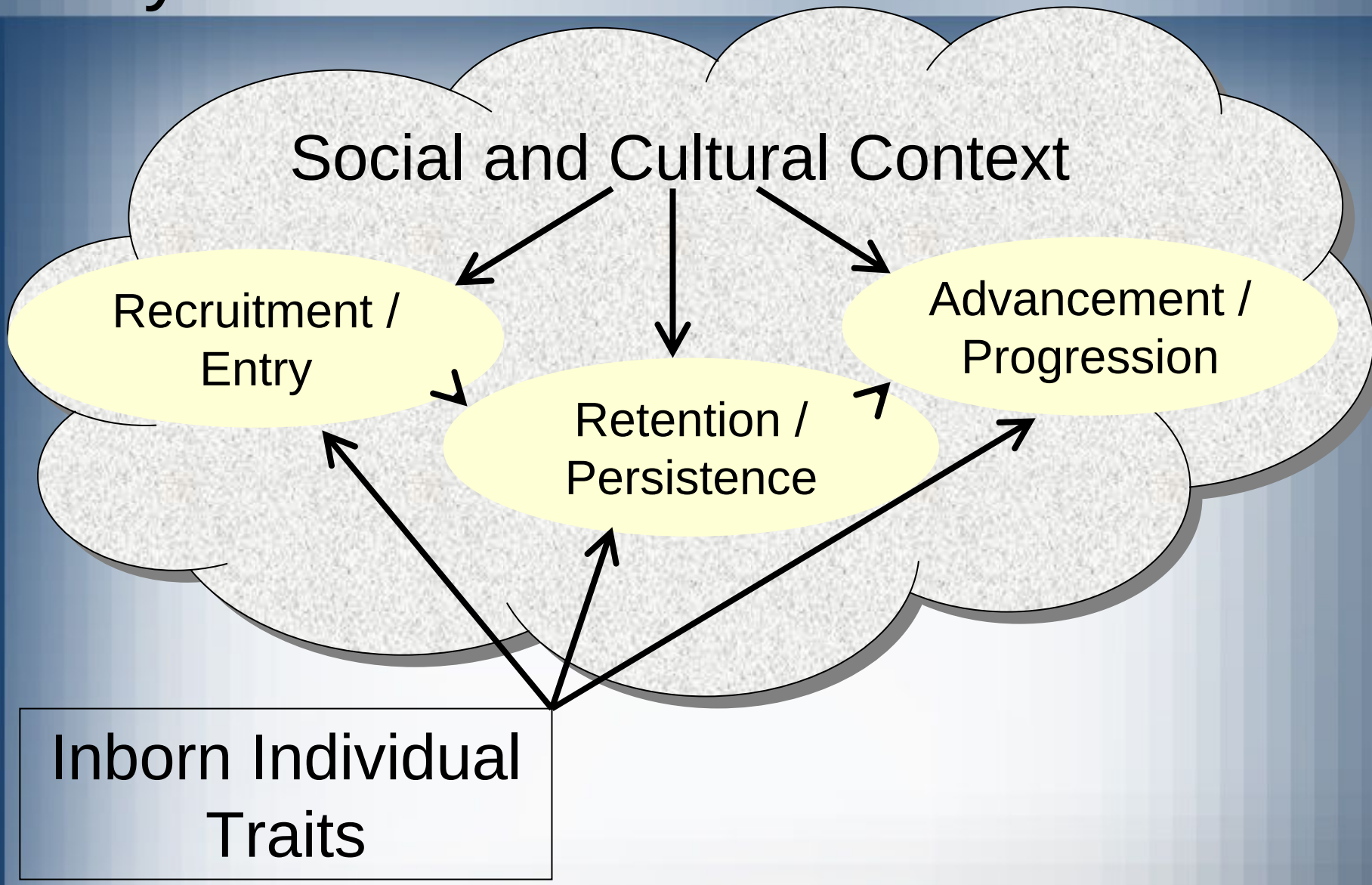
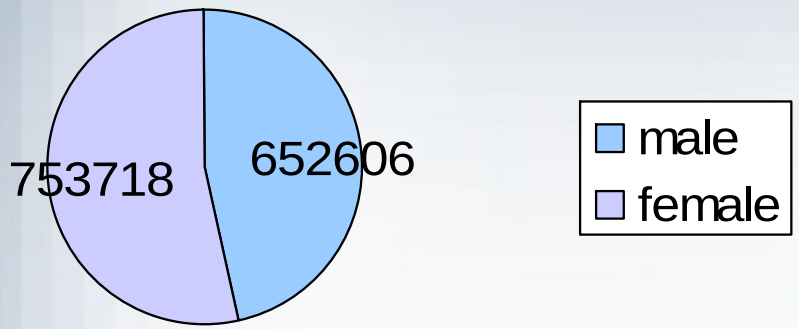
Why?

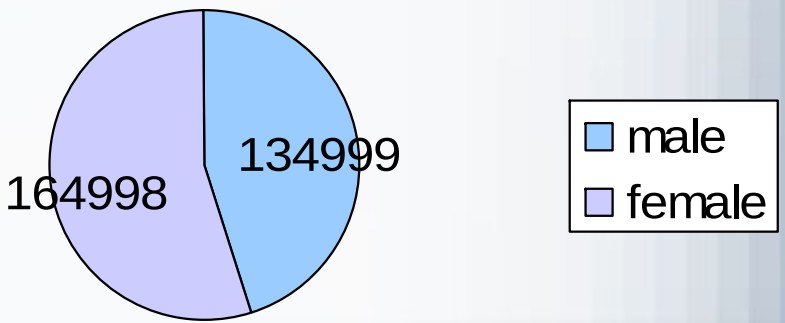

Social and Cultural Context
Recruitment / Entry
Retention / Persistence
Advancement / Progression
Inborn Individual Traits

Differences in Math Foundation?

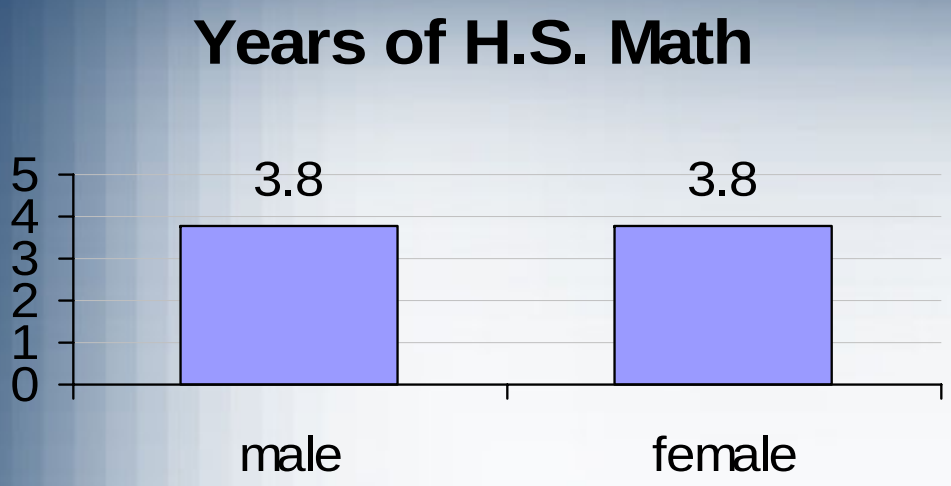
SAT-Takers, 2003

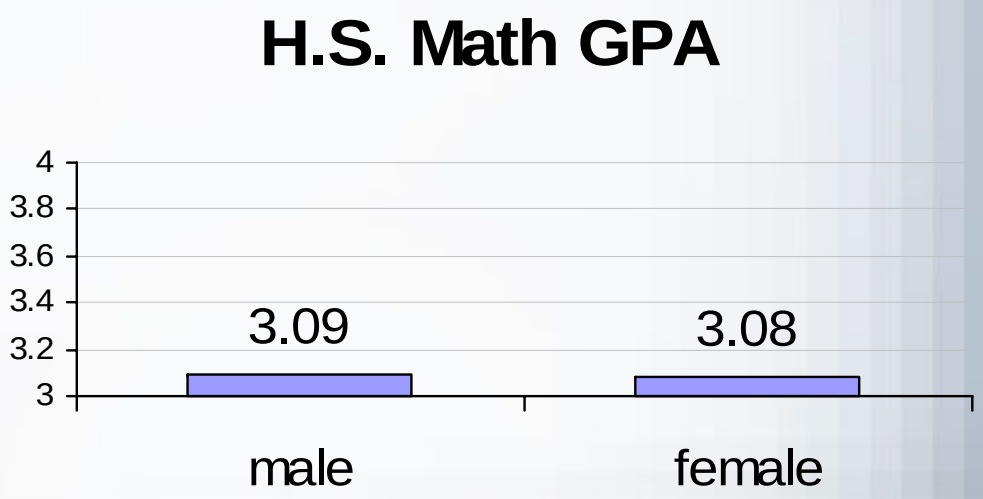


Honors Math Course

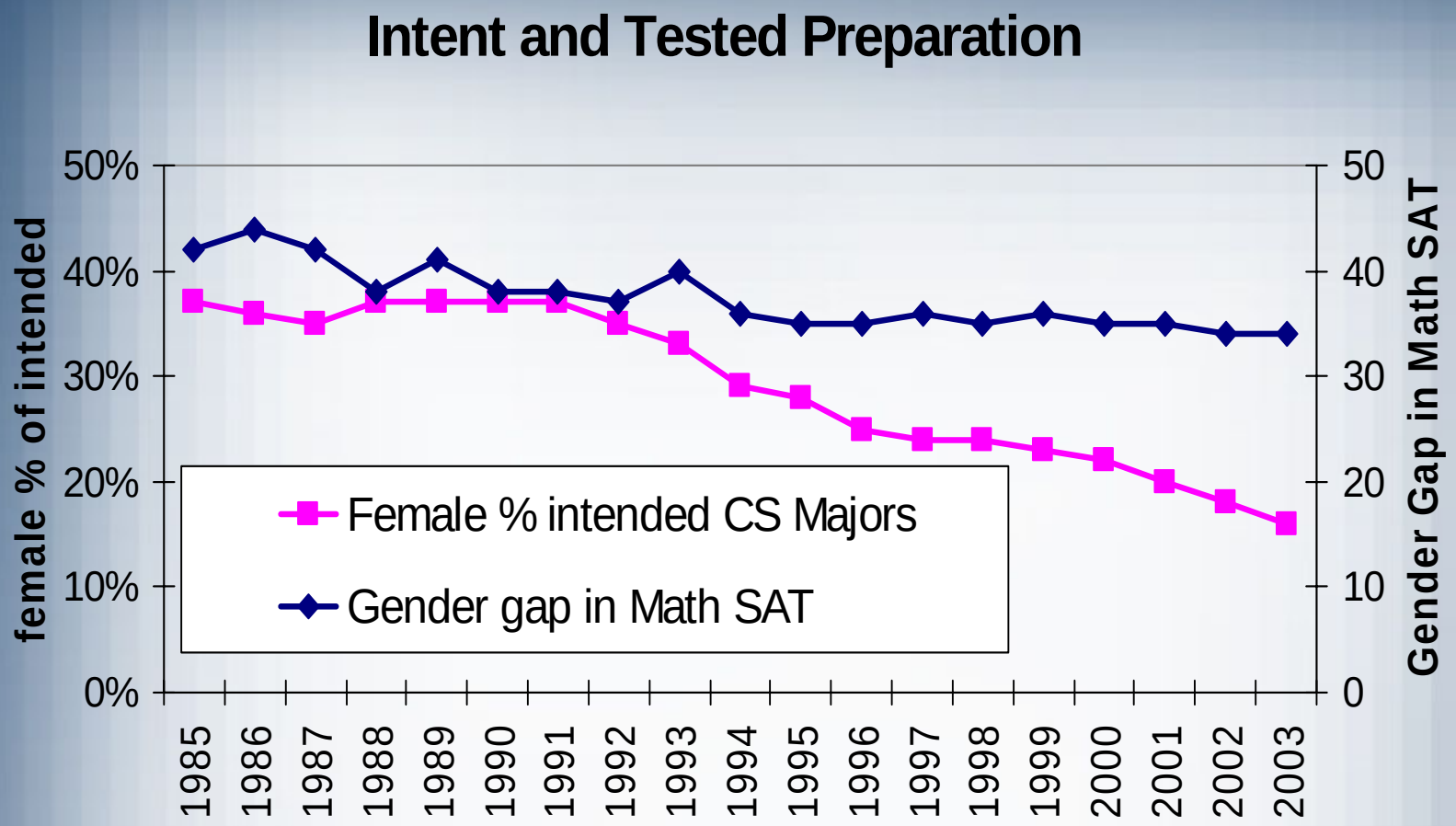


Differences in Math Foundation?





Mathematics SAT Score?



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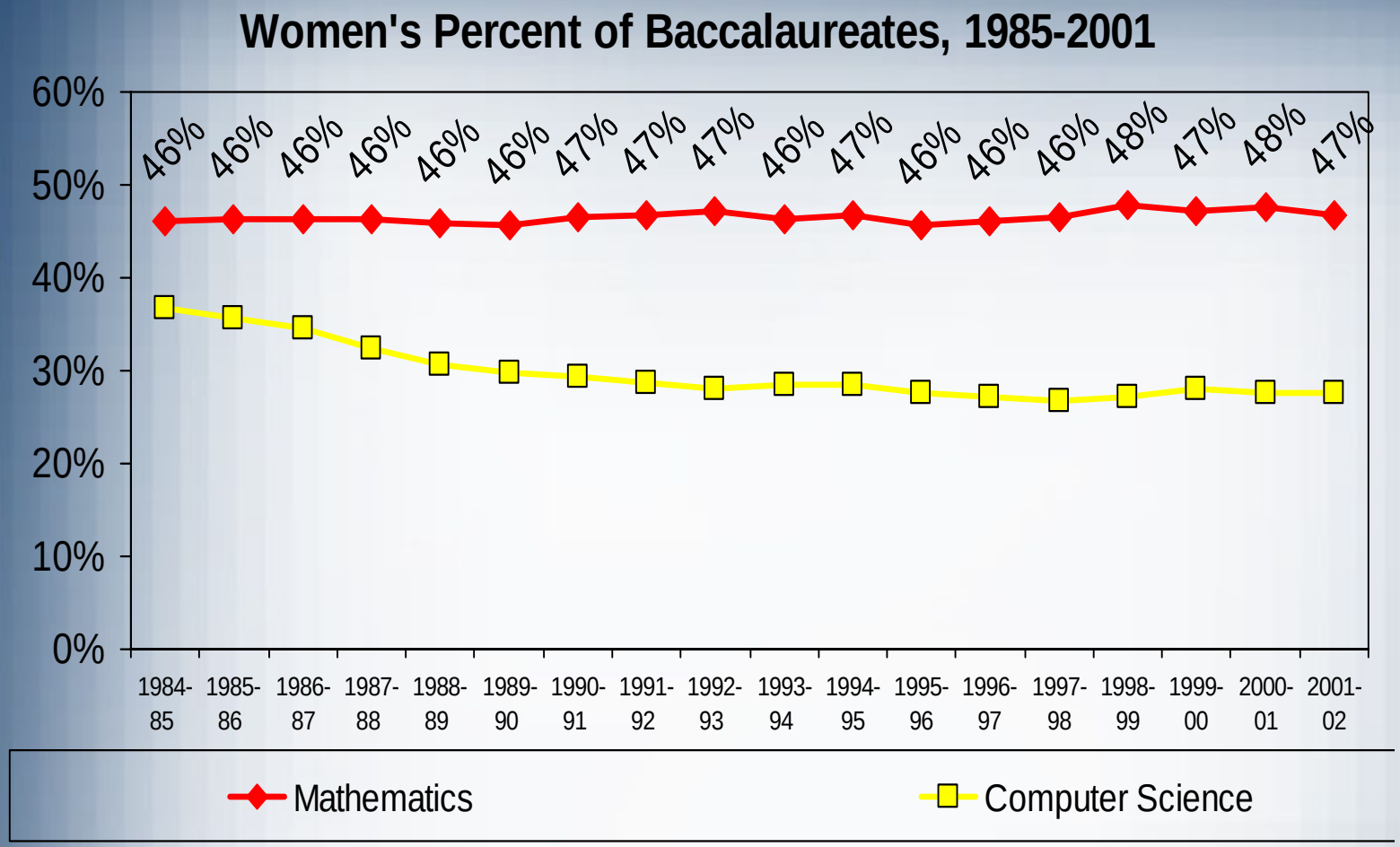
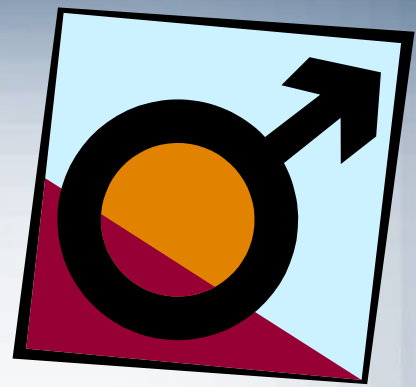
Can’t Do the Math?



Data source: National Center for Education Statistics, IPEDS data

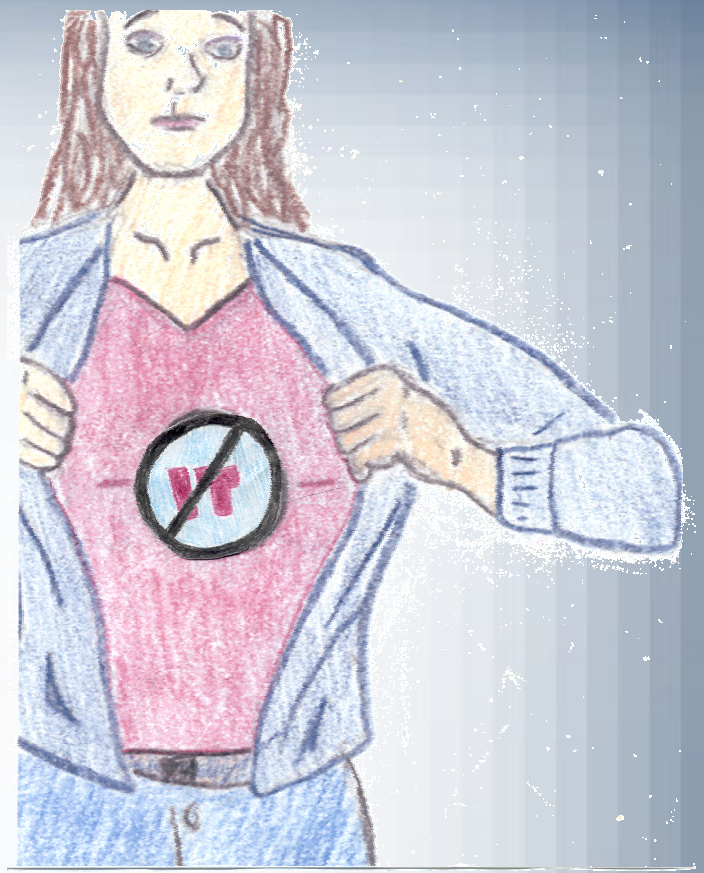
Stereotypes

- Masculine image
  - *I guess life just isn't fair until women grow chest hair, spit, chew, bench press 250 pounds, and write a computer program … - Male Computer Consultant on ZDNN, 1998*



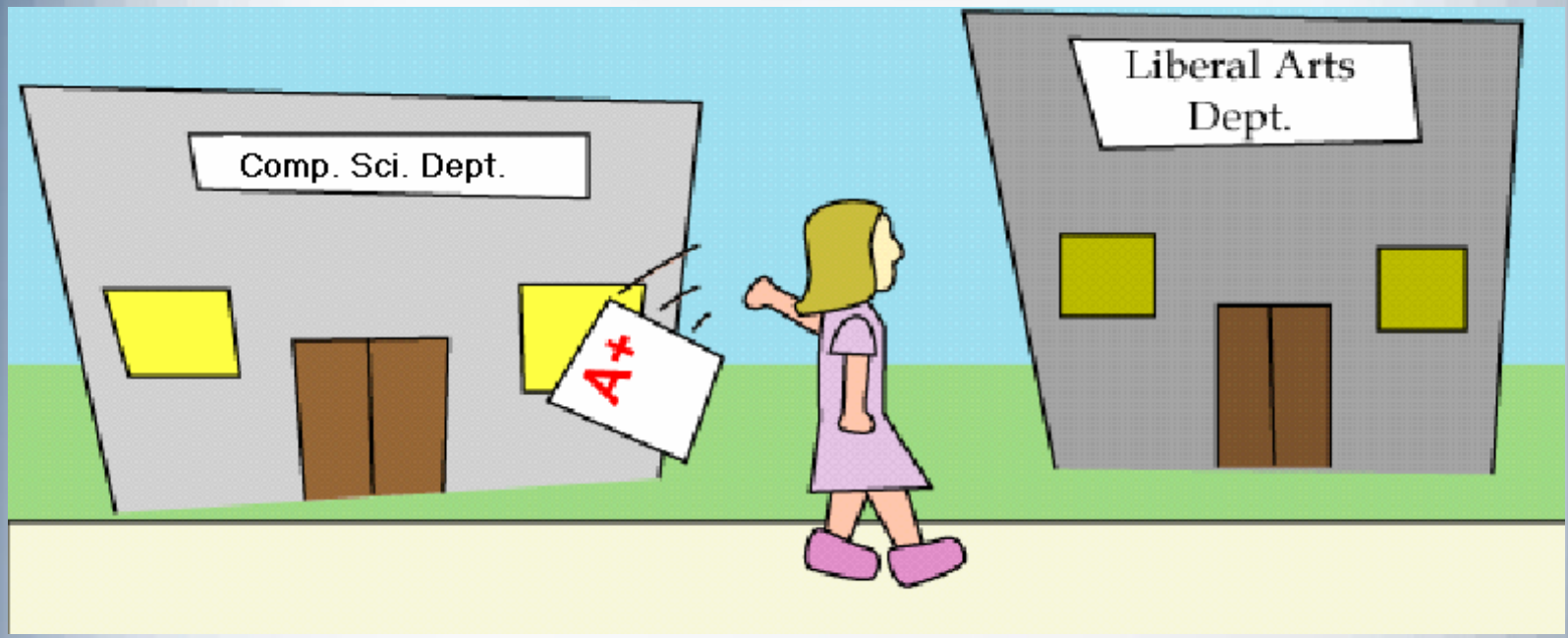
Stereotyped Tasks → Self-doubt

- Women CS majors less confident than even male non-majors (Beyer)
- Regardless of academic success
- Behavior conforms to noted stereotypes



Able Women Go Elsewhere

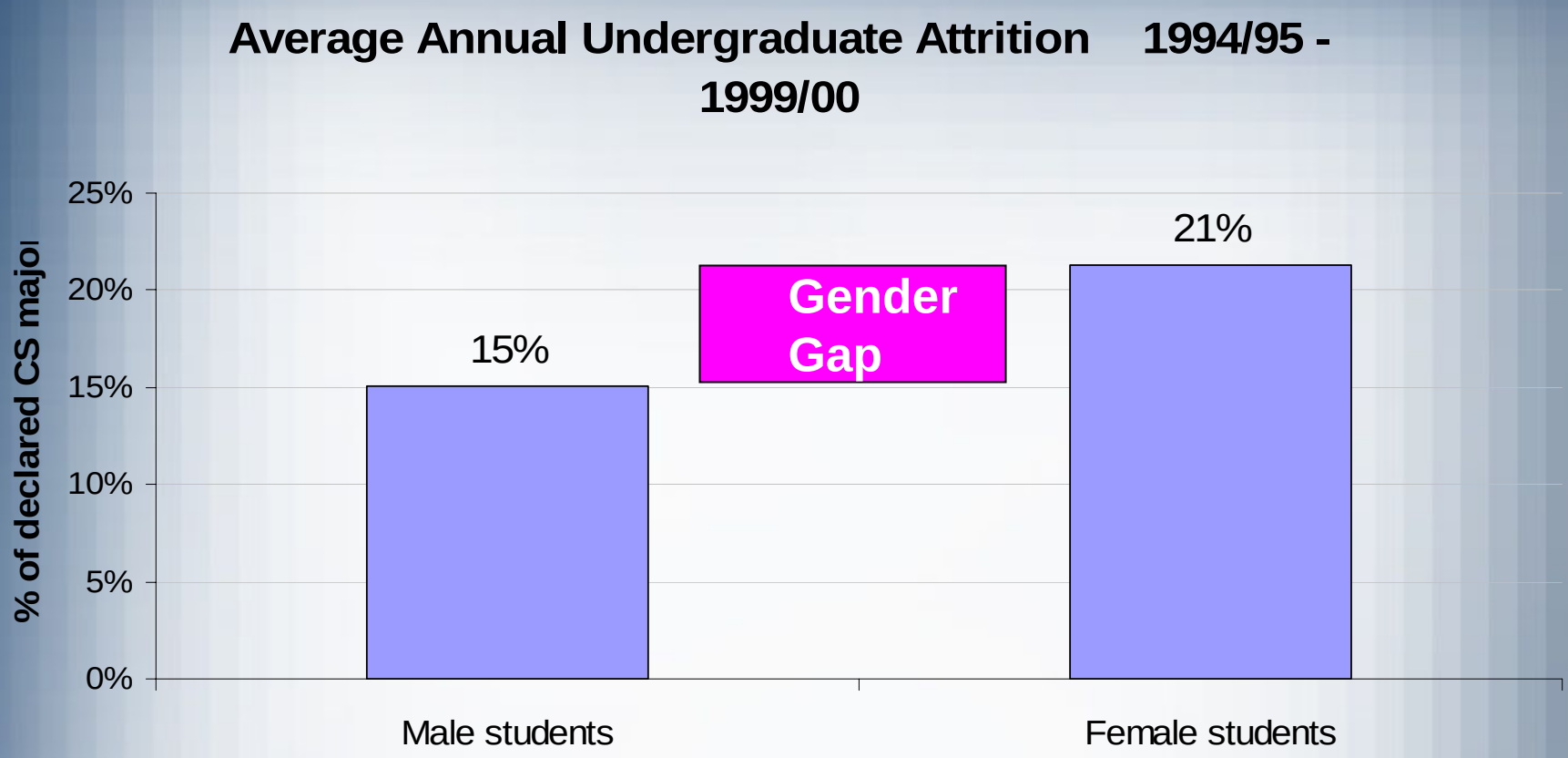
- ***She got an A in Computer Science [Intro] in the fall and an A+ in [Calculus I]. And do you know what she's taking this semester? English, Psychology, and Music.*** **- CS Faculty Member**



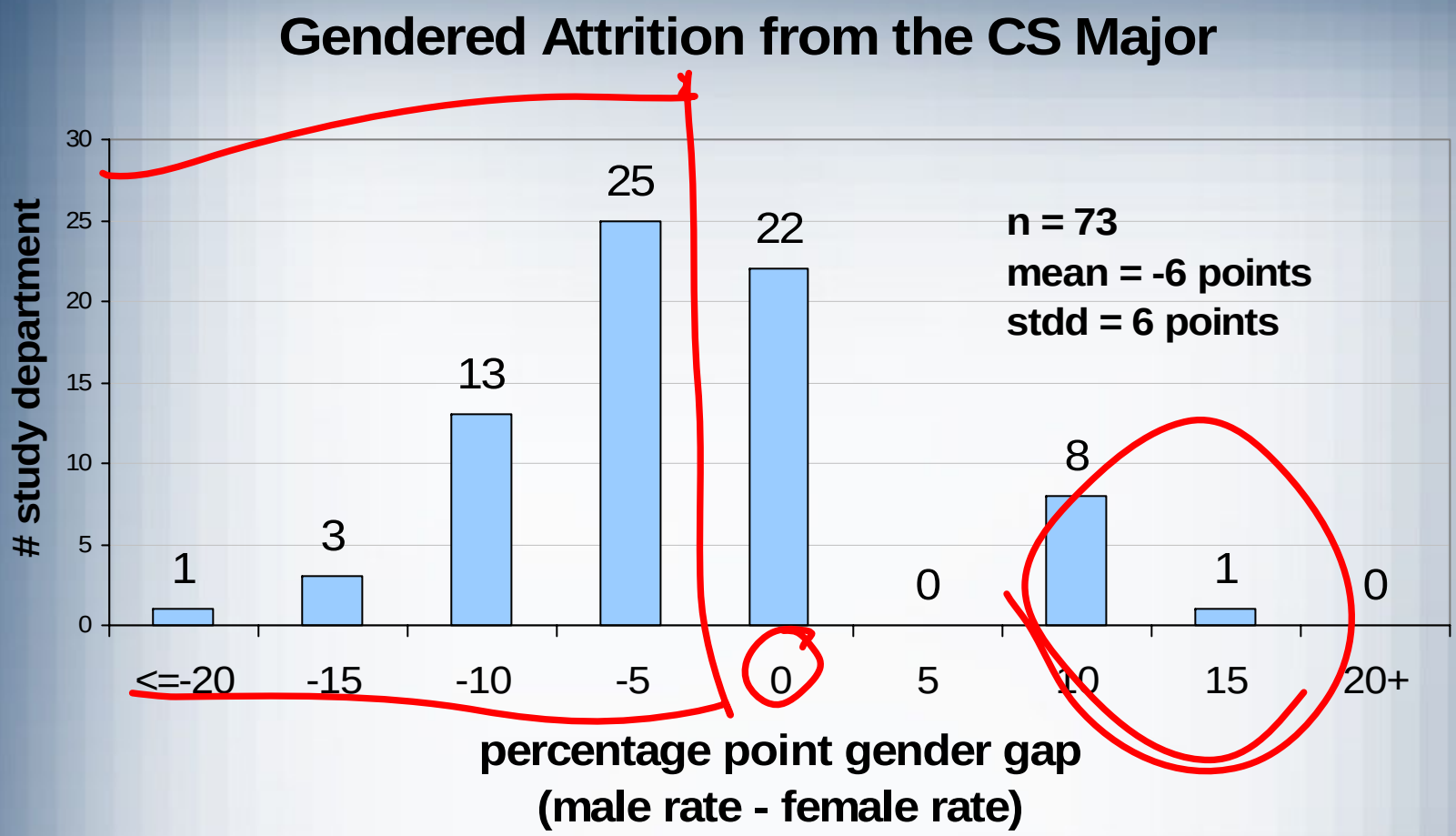
Two Nationwide Studies

- Undergraduate study of attrition
  - Cohoon, Cohoon, and Turner
- Graduate study of recruitment & retention
  - Cuny, Aspray, Cohoon, and Jesse
- Focus on department or program environment

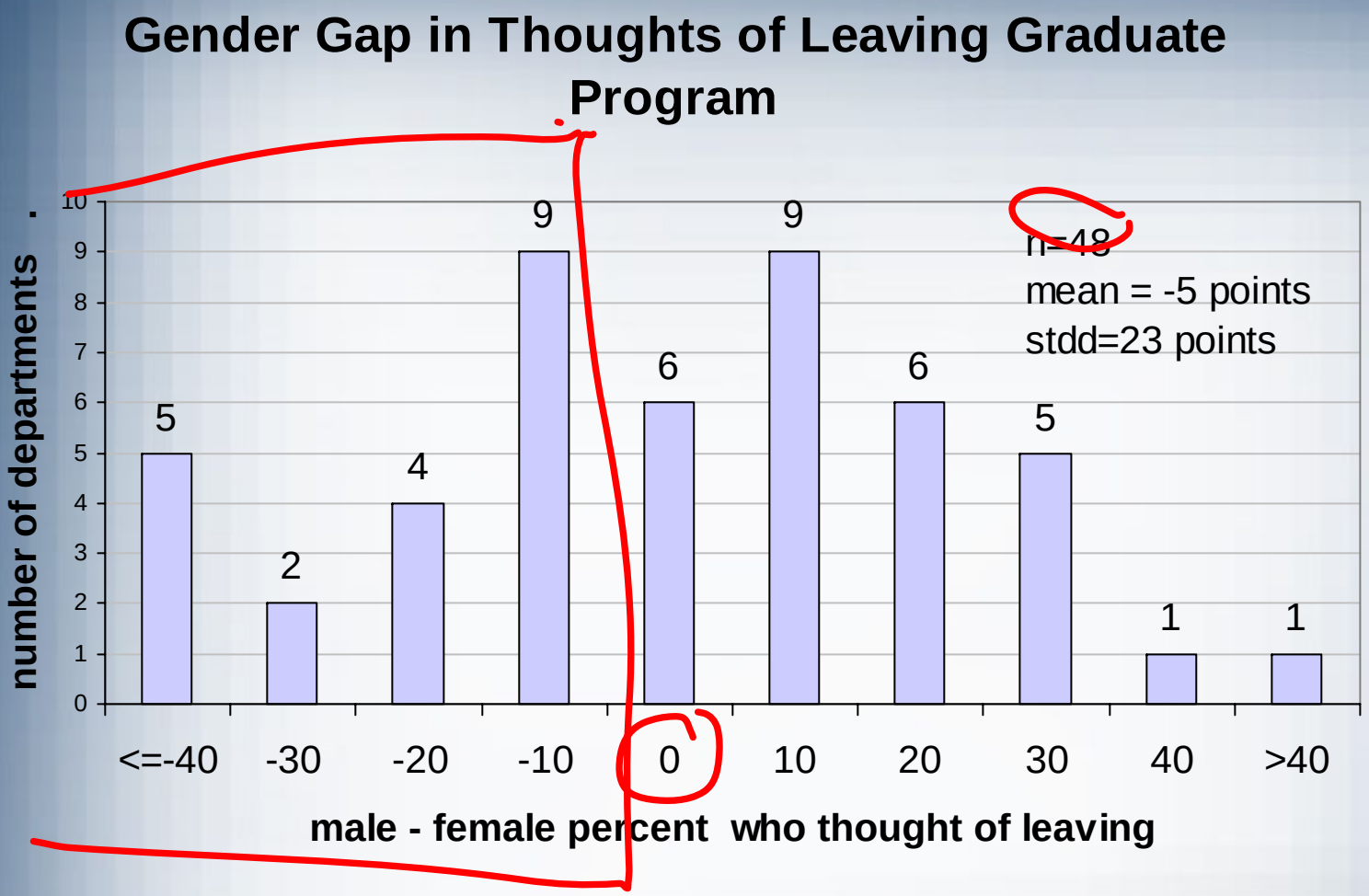
Gendered Attrition from CS



Departmental Variation



Graduate Program Variation



Research Question

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

Methodology – Undergraduate Study

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

Methodology – Undergraduate Study

- 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 – Undergraduate Study

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

Research Question – Graduate Study

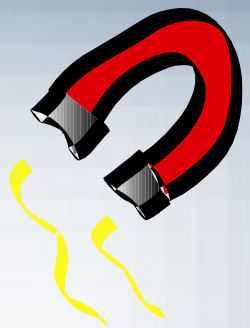
- What departmental characteristics are associated with the size of the gender gap in students thoughts of leaving?

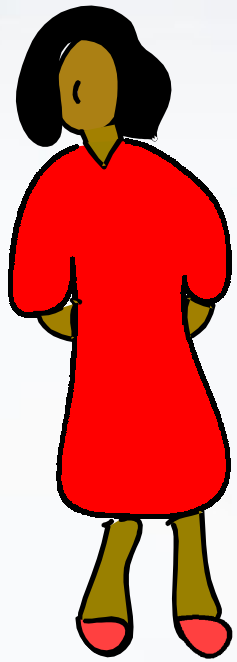
Methodology - Graduate Study

- Interviews and pretests
  - 3 programs
  - 1 national conference
- Survey
  - 49 programs
  - 2046 grad students (55% response rate)
  - 812 faculty (64% response rate)
  - 47 chair (96% response rate)

Attracting Women to Undergraduate CS

- Common attractions
- Women in particular





Common Attractions

- Positive prior experience
- Encouragement
- Math or logic confidence
- Enjoy programming
- Career rewards, flexibility, opportunity

I got addicted to that rush that you get with programming.
- Woman CS Major

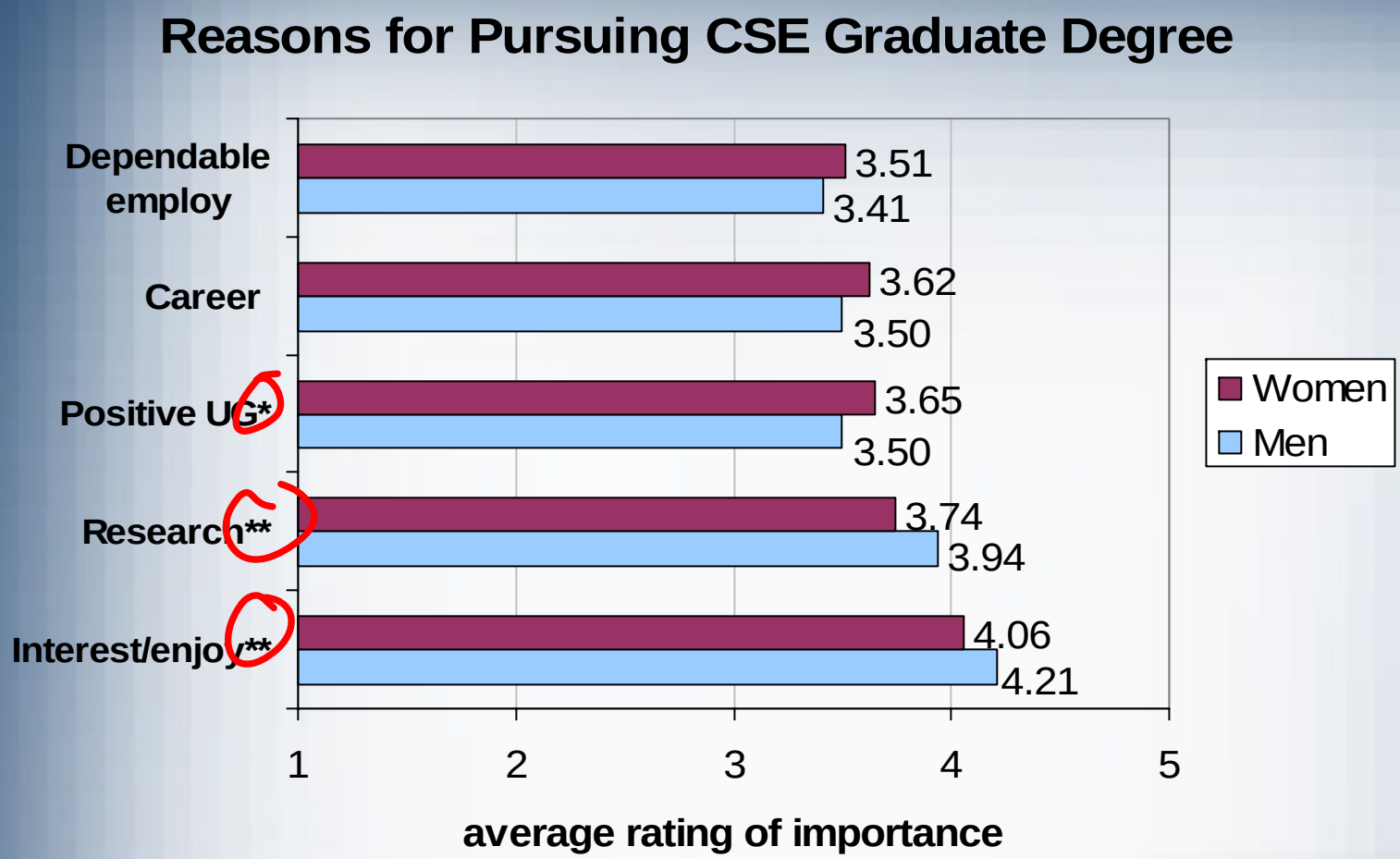
Attractions for Women

- Communication or creative self-expression
- Path to a helping occupation
- Recruited by peers
- Defy gender stereotypes

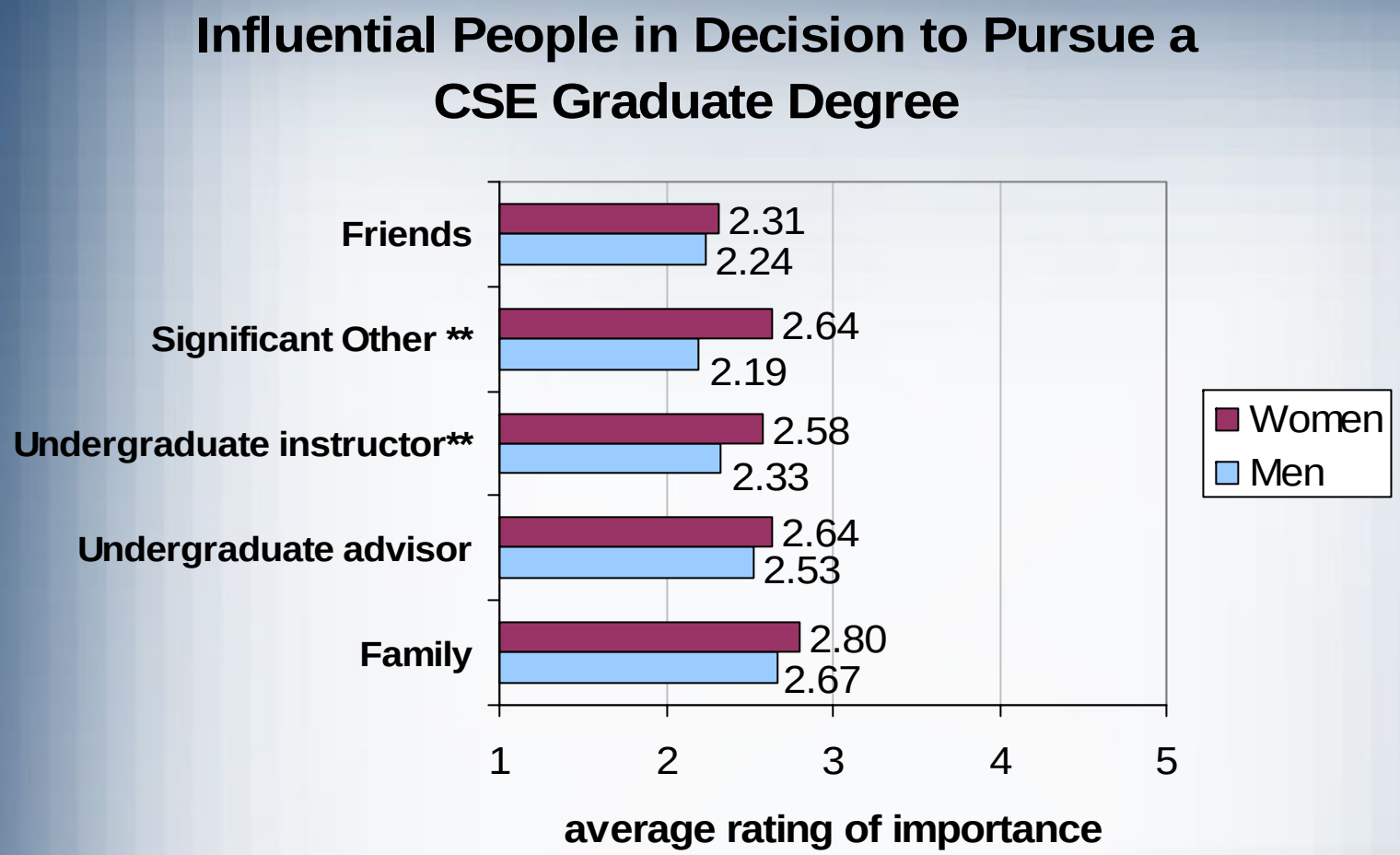
I came here as a Psychology major, had never touched a computer, had no intention of ever touching a computer other than for word processing. And a friend convinced me to take Intro to Computers … for non-majors.

- Woman CS Major

Attraction to Graduate Study in CSE



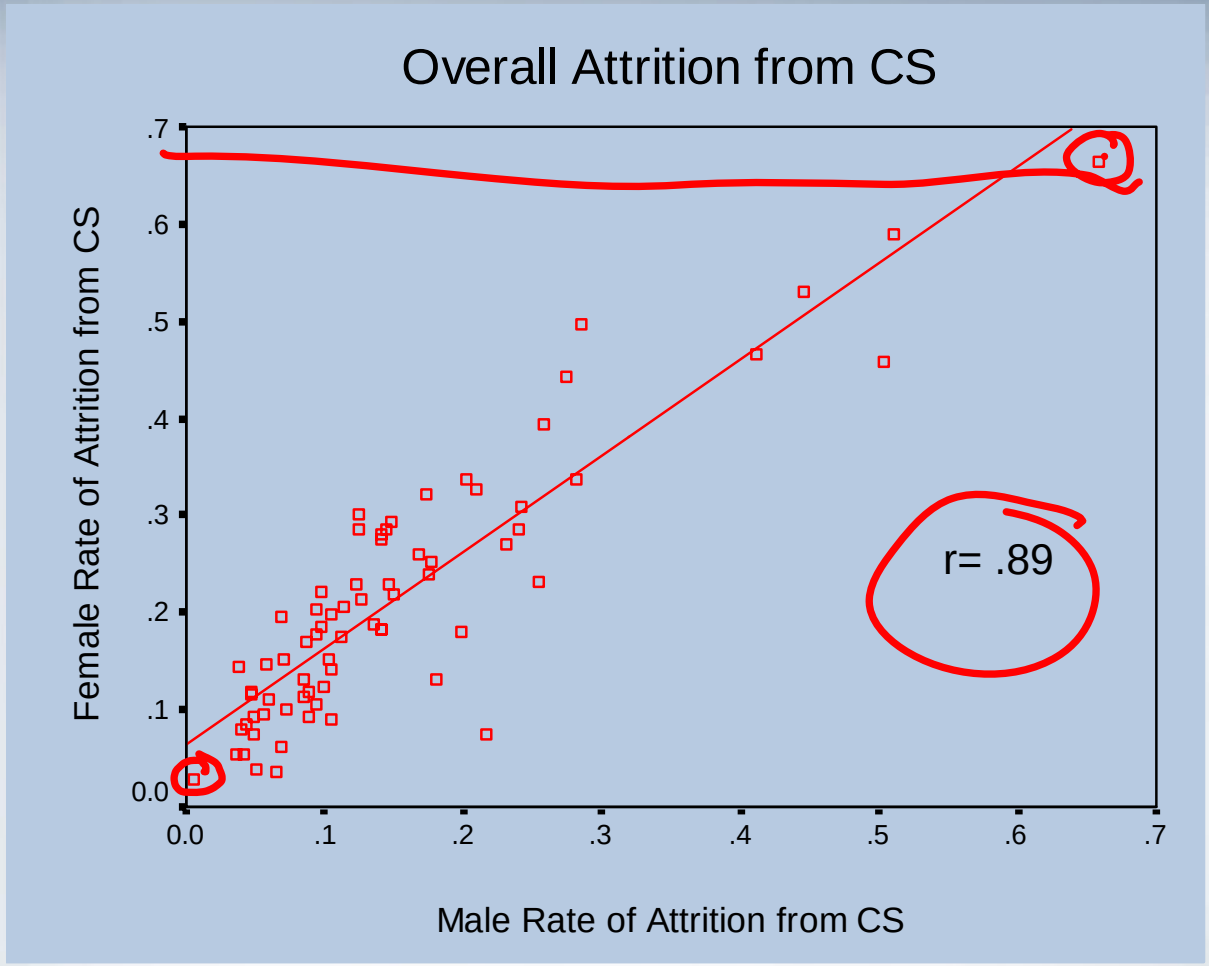
Recruiters to Graduate Study



How Are Women Retained?

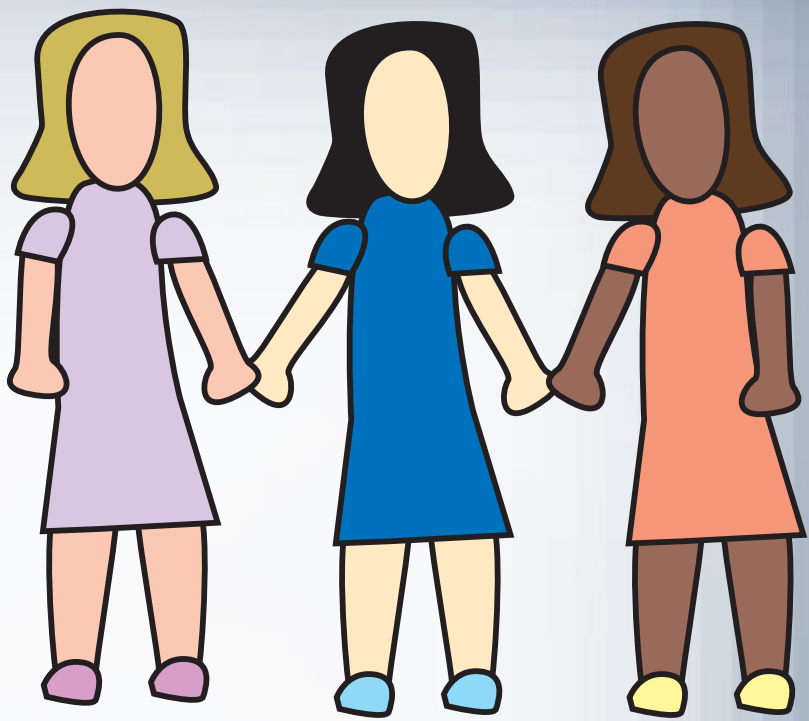
- Same as men for the most part
- Peers
  - Same-sex peer support
- Faculty
  - Encourage
  - Mentor for diversity
  - Expect work and focus
  - Adequate faculty

Leaving Under Same Conditions



Same-Sex Peers Retain Women

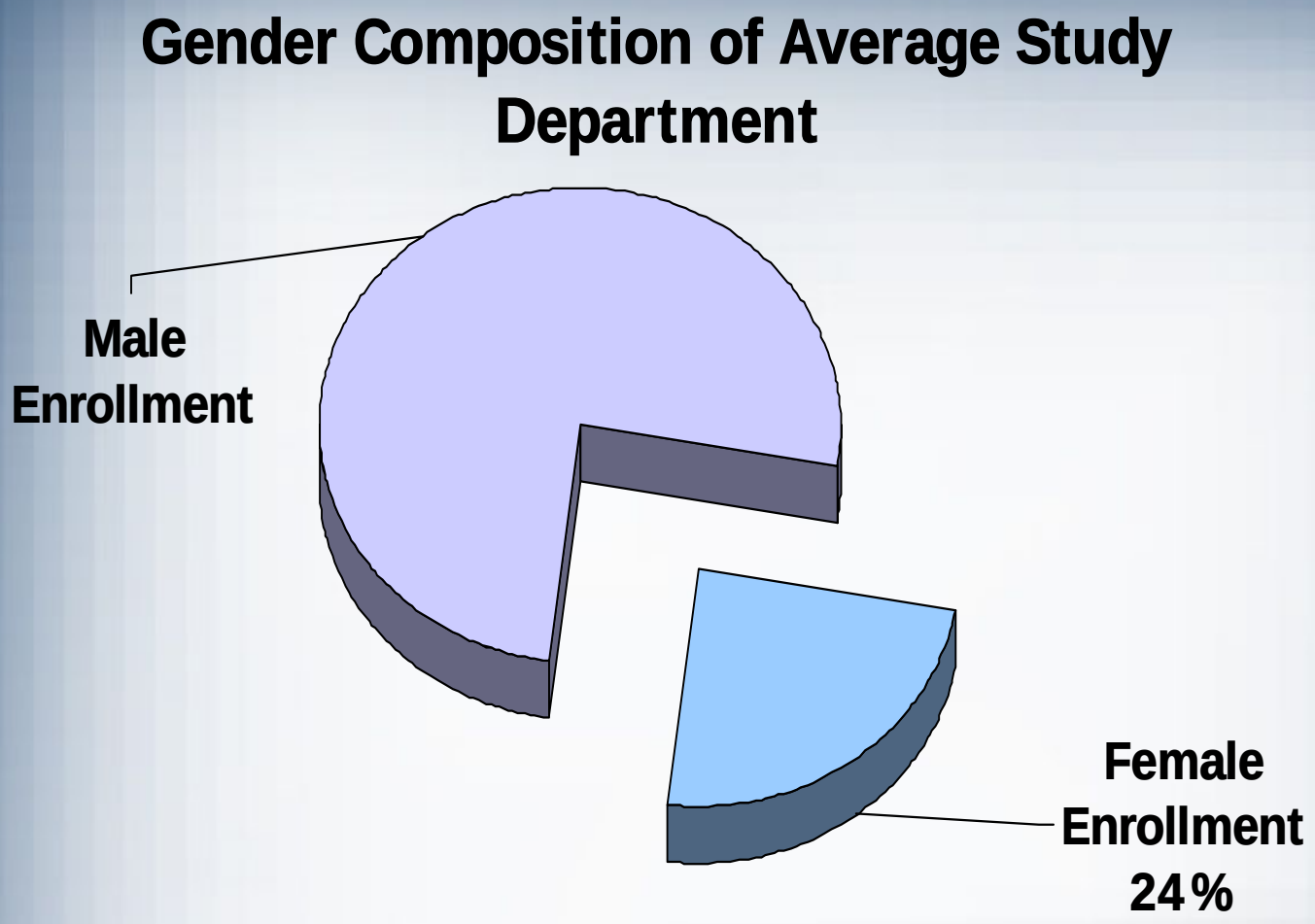
- Women help retain women undergraduates



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



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.***

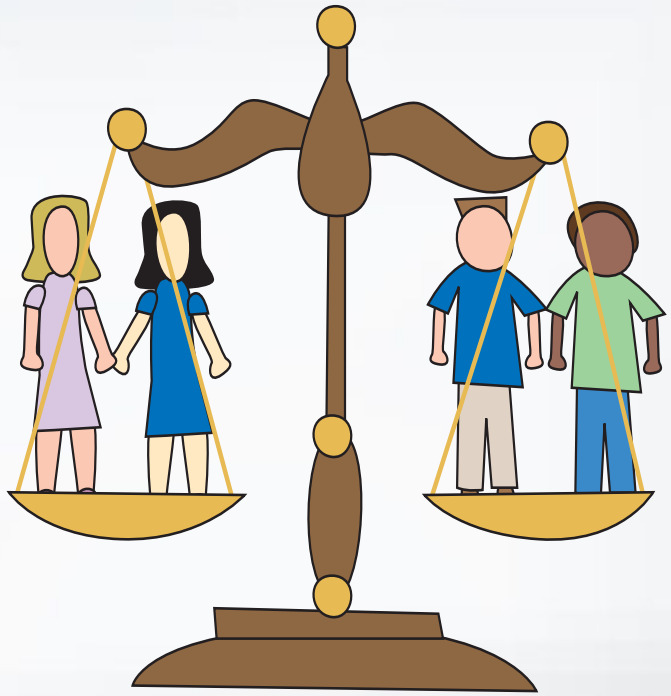
    - Female CS Majors in the same focus group

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



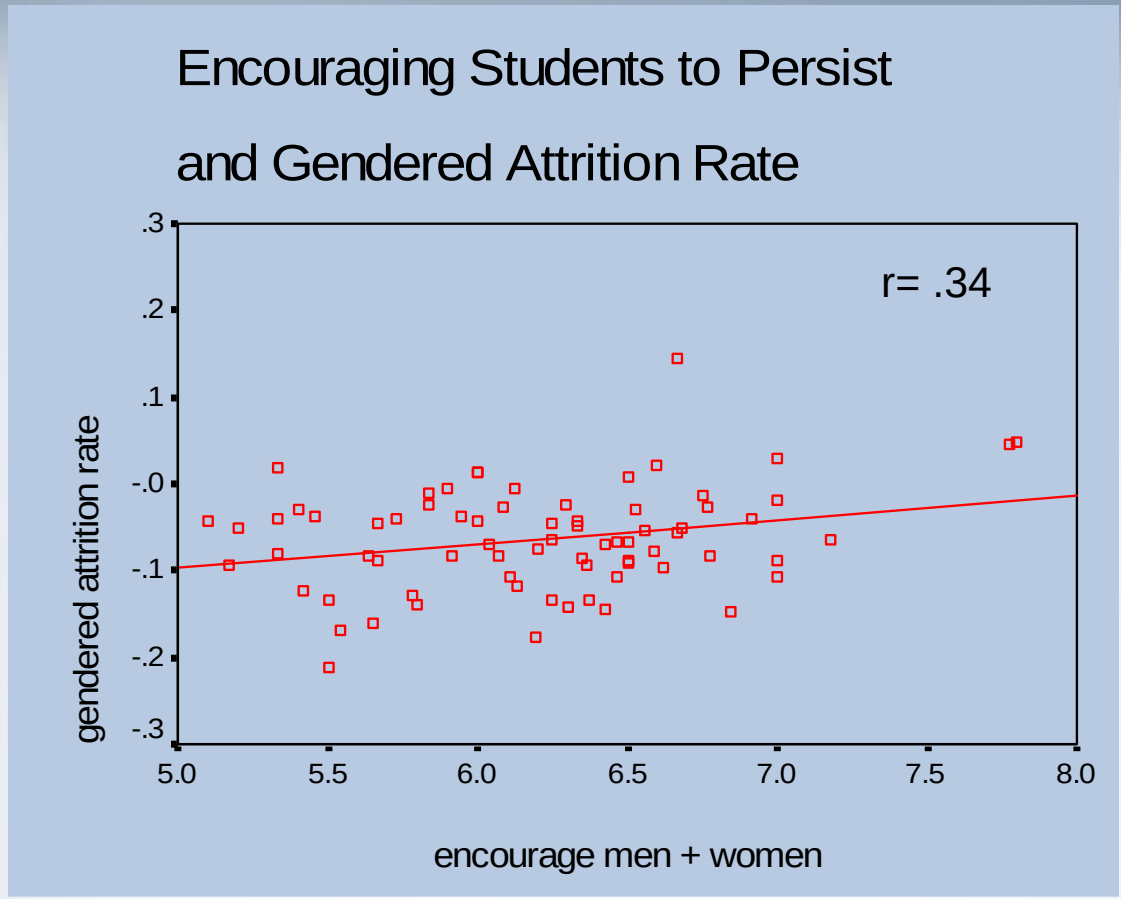
Faculty Help Retain Women

- 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 under-representation
- 23% of faculty initiate mentoring

Two Types of Mentoring

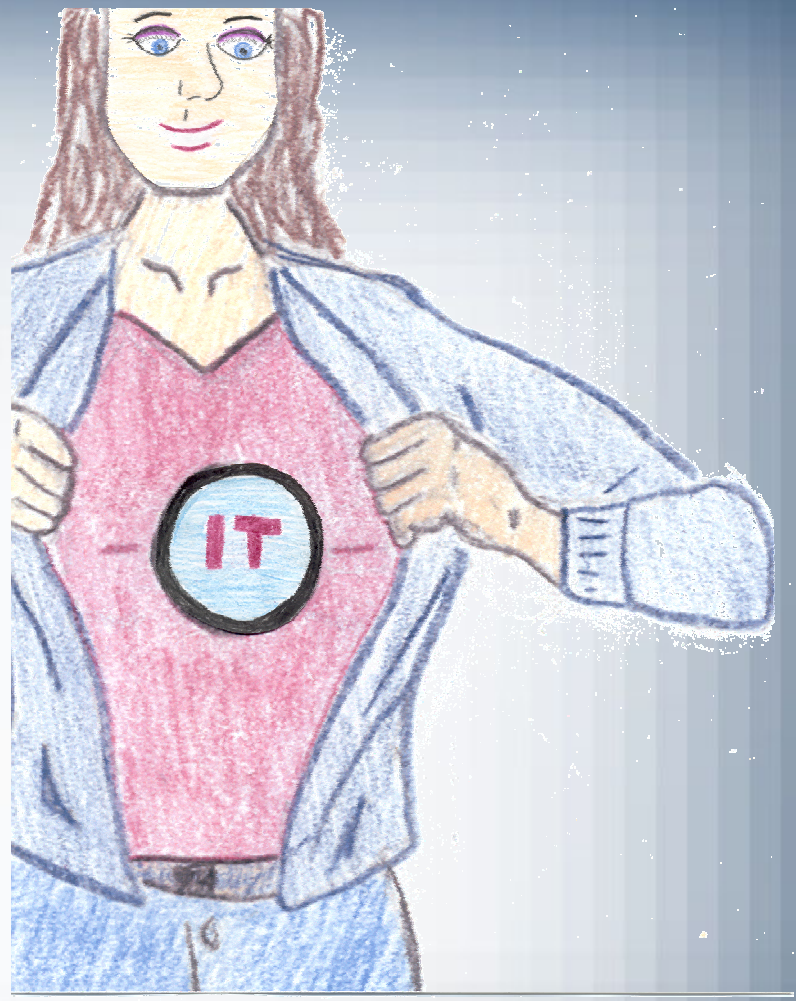
- Support mentoring
  - Help navigate rules
  - Encourage shy but competent students
  - Specific positive feedback
- Research mentoring
  - Involve students in research
  - Publish with students
  - Inform students of research opportunities
  - Supervise non-course-related work

Advancing Students

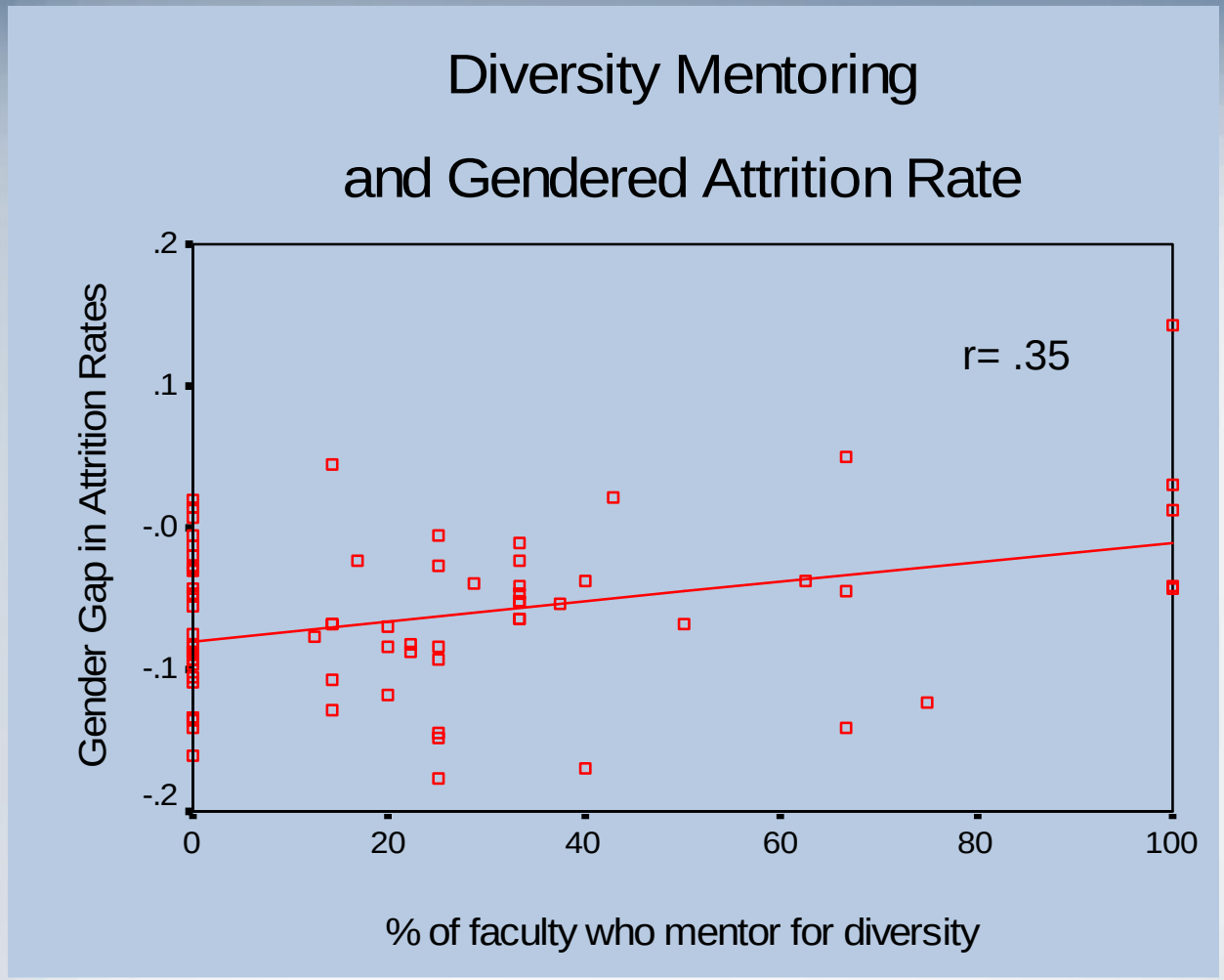
- Support mentoring ↑ progression to graduate study
- Research ment
  graduate progra

Outcomes of Mentoring

- Advance to graduate study
- Retain women through diversity mentoring



Mentoring for Diversity



Hard Work and Focus Don’t Hurt

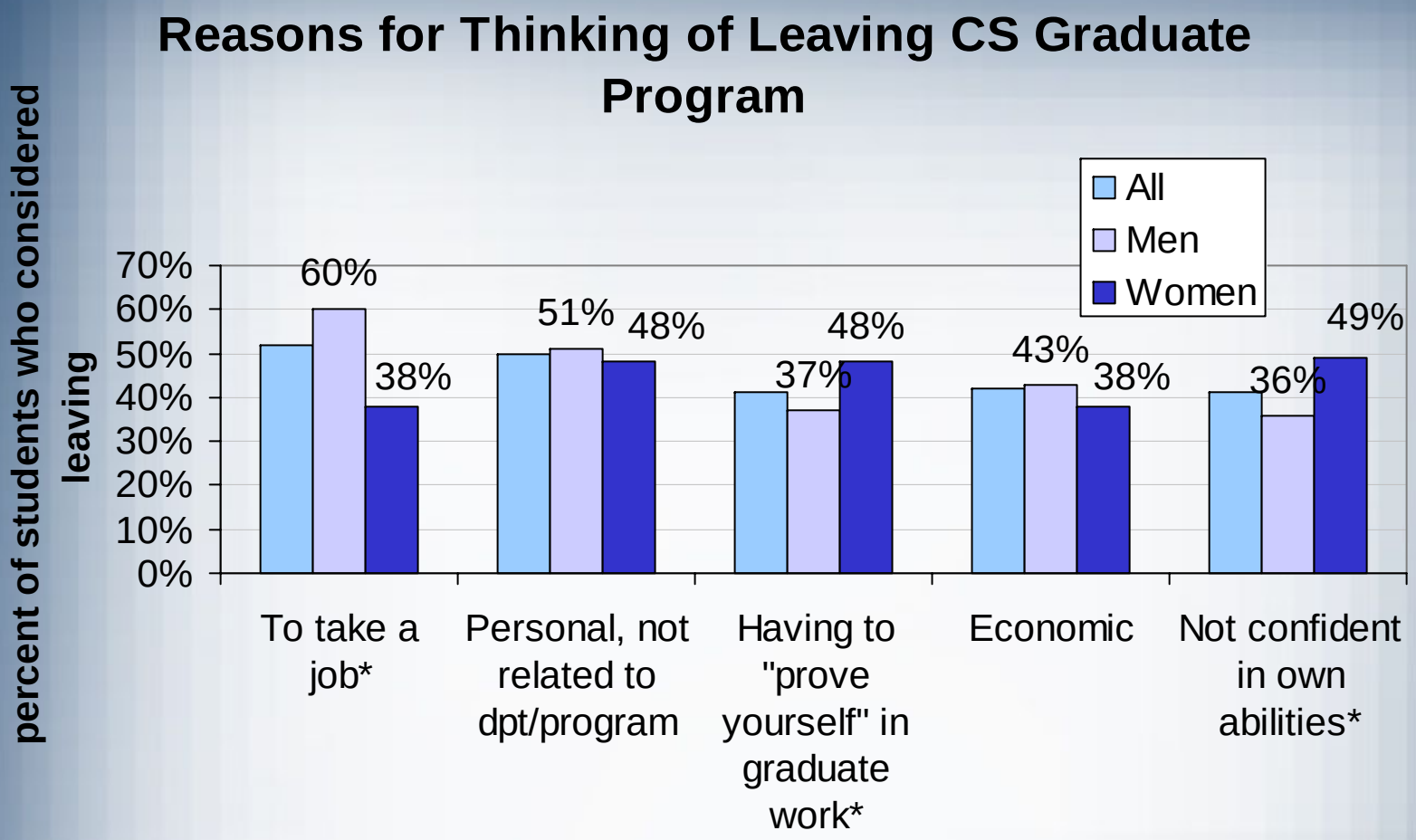
- Undergraduate women succeed when faculty
  - Emphasize homework (average 7 hrs/week/course)
  - Expect focus

***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 = .56 for undergraduates
  - Concern over insufficient faculty
  - Faculty who encourage
  - Faculty expect academic focus
  - Mentor for diversity
  - Female percent of enrollment
  - Hours of homework

Leaving Graduate CSE Programs



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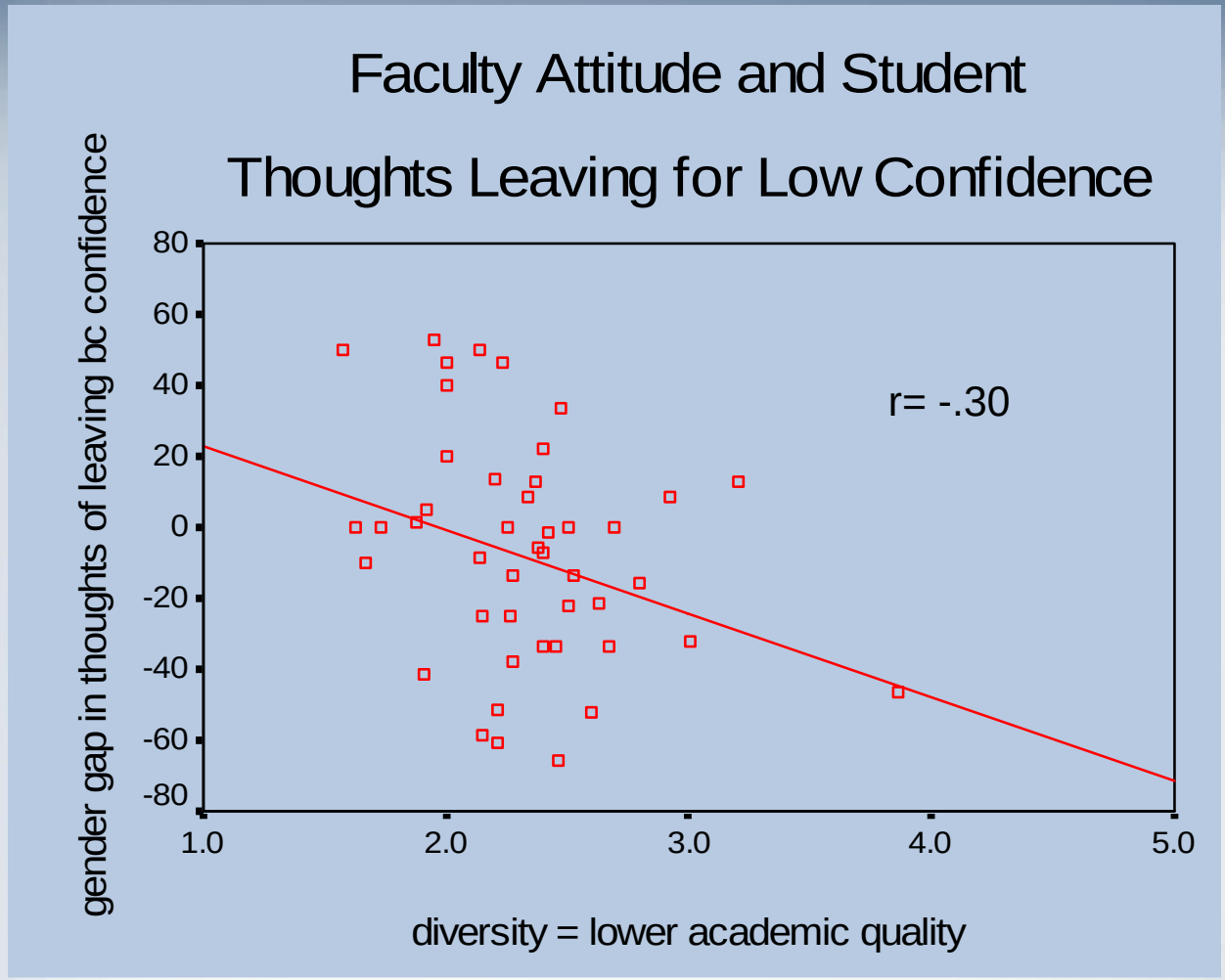


So What Do We Know?

- Clues about attracting women
- 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

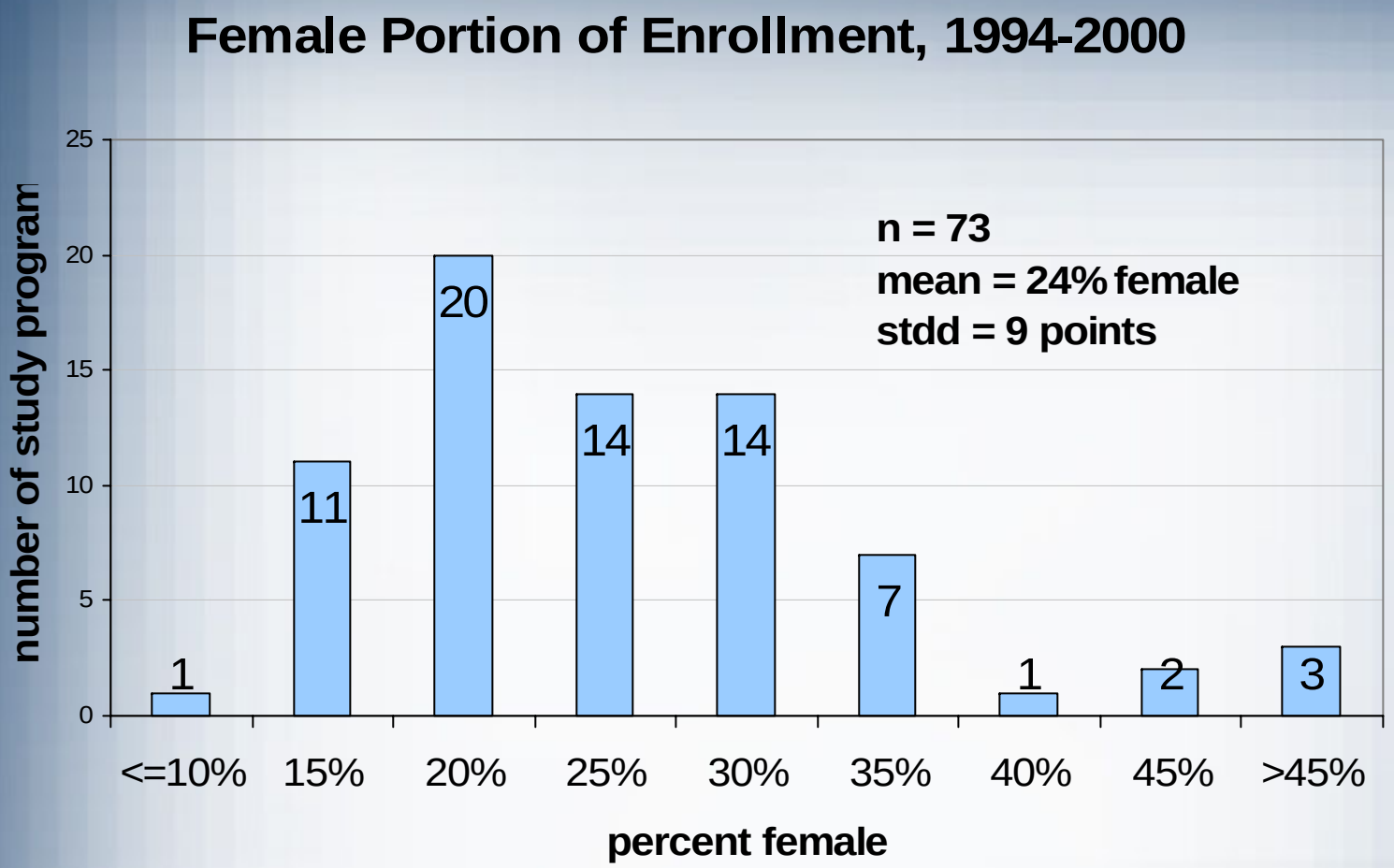
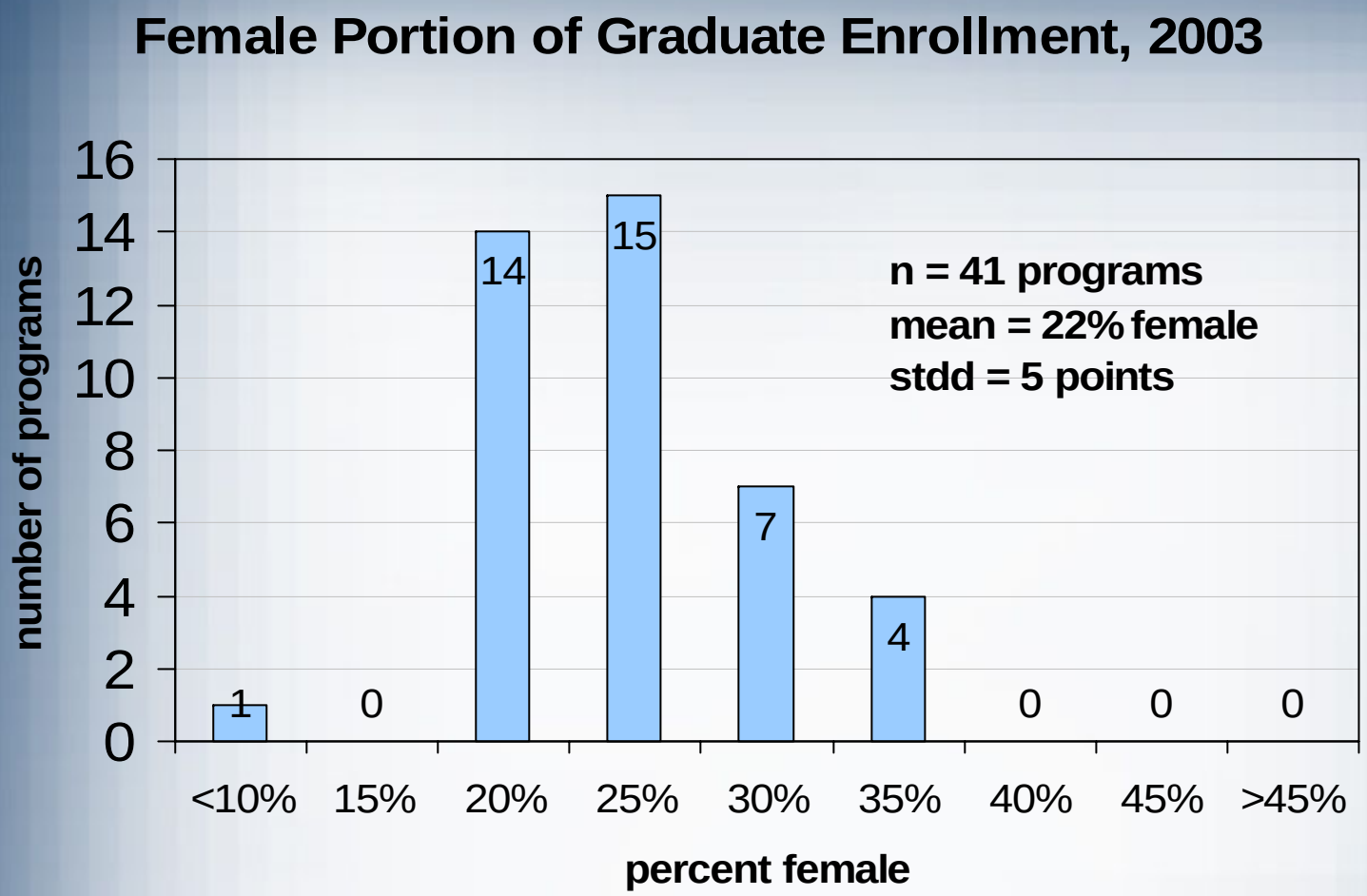
More Information

- 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

Variation in Undergraduate Programs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