

Studying the Gender Gap in Undergraduate Computer Science

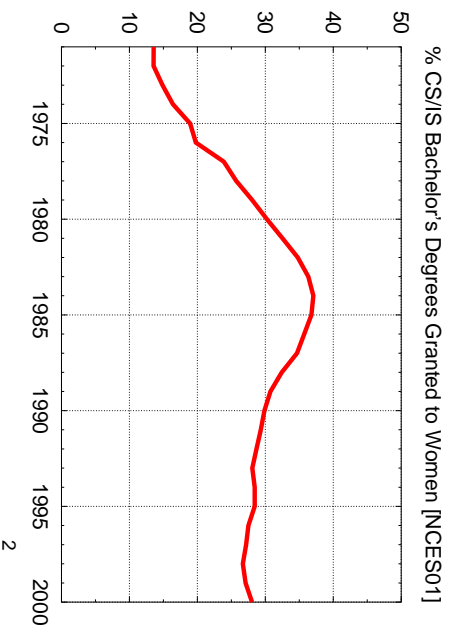
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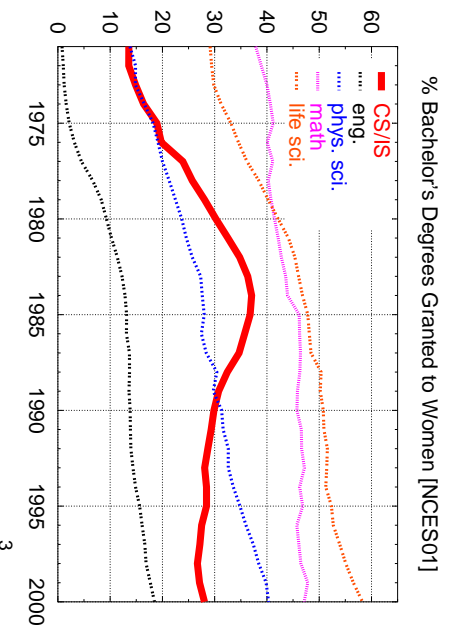
General Exam Presentation

06 Feb 2003

Growing Gender Gap in CS



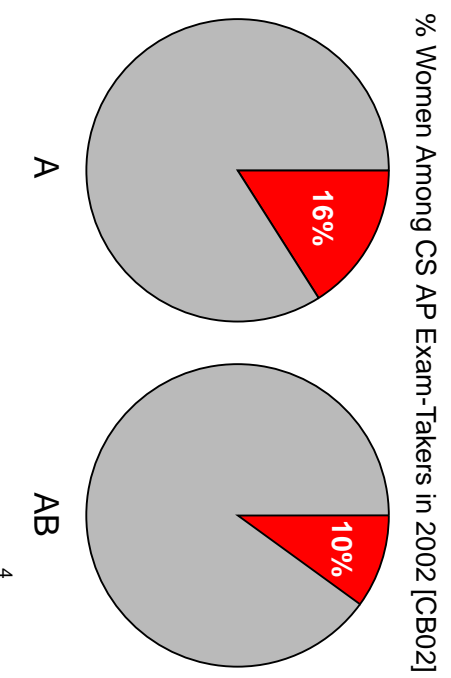
Only CS Falling Behind



CS Gender Gap's Significance

- fairness
- strength from diversity
- supply of workers, teachers [CRA99]
- intriguing puzzle

Gender Gap in CS AP Participation



Presentation Outline

1. overview of analyzed studies
2. cross-study analysis of selected factors
 - self-confidence
 - prior background in computing/programming
3. pitfalls / guidelines for future work
4. future work

Challenges of Studying Persistence

- identifying relevant factors
- understanding student decision-making
- contacting nonpersisters

Approaches to Studying Persistence

- focus on introductory courses
- statistical correlations, predictors
- ethnography

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Eight CS-specific Studies

- [MF02] Margolis & Fisher, *Unlocking the Clubhouse*, 2002.
- [W1102] Wilson, *Comp. Sci. Education* 12(1–2), 2002.
- [Coh01] Cohoon, *Comm. of the ACM* 44(5), 2001.
- [SS98] Scragg & Smith, *SIGCSE* 1998.
- [SP96] Sackrowitz & Parelius, *SIGCSE* 1996.
- [BC95] Bunderson & Christensen, *J. of Research on Computing in Education* 28(1), 1995.
- [CC89] Clarke & Chambers, *J. of Educational Computing Research* 5(4), 1989.
- [JLS88] Jagacinski et al., *J. of Educational Computing Research* 4(2), 1988.

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Overview of CS-specific Studies

- mostly one-time surveys, institutional records
- mostly single institution
- one longitudinal ethnography [MF02]
- one on departmental characteristics [Coh01]
- varying coverage of commonly cited factors

Two Math/Science Studies

[SH95] Seymour & Hewitt, *Science Education* 79(4) and *Talking About Leaving*, 1995–7.

[SEA+94] Strenta et al., *Research in Higher Education*, 1994.

- both multi-institution
- one ethnography [SH95]
- one at “highly selective” institutions [SEA+94]

Presentation Outline

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Selected Significant Factors (1 of 2)

- self-confidence
 - success in course
 - comfort, ability
- prior background
 - computer ownership
 - programming (formal, informal)

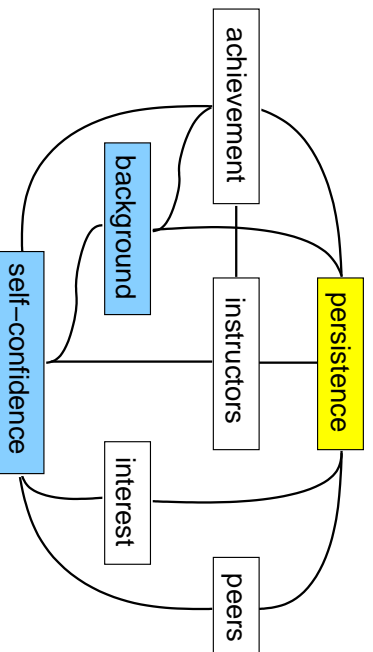
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Selected Significant Factors (2 of 2)

- (discussed in report, but not in this presentation)
- teaching
 - quality
 - accessibility
 - overt discrimination
 - social influences
 - peers
 - family
 - role models
 - instructor encouragement

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Studied Factor Interactions



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- interest in field [MF02]
- achievement [W1102, AAUW95]
- seeking out help [SH95, SEA+94]

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Related to Self-Confidence

Measures of Self-Confidence

- Self-Assessment:** Asking students to rate their own...
- ability, knowledge
 - chances of academic success
 - sense of belonging in field
 - comfort with, frequency of class participation

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The Self-Confidence Gap in CS

- Women students tend toward lower self-confidence.*
- sense of belonging [SH95]
 - feelings on ability, success [SH95, SEA+94, SS98, CC89, W1102]
 - reliance on external encouragement [SH95, MF02, CC89, Coh01]

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Perceived vs. Actual Ability

Women's academic achievement is at least as high as that of men. [SEA+94, CC89, JLS88, MF02, WII02]

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Self-Confidence Summary

- lower self-confidence
- ...with no basis in actual ability
- related to interest, achievement, persistence...

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Influence of Prior Background

- choice of major [MF02, SEA+94]
- early achievement (vs. long-term success) [WII02, CC89, MF02, SP96]

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Computing/Programming Background

Young women have less experience and fewer opportunities with computing and programming.

- high school programming coursework [CC89, SP96, WII02, CB02]
- computing and programming experience [CC89, SP96, MF02]
- computing at home [MF02, CC89]

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Hidden Prerequisites

Students believe prior background is required for success in the course. [BC95, JLS88, MF02]

CS courses are oriented toward students with prior programming experience. [MF02, SP96]

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Prior Background Summary

- less computing/programming background
- disadvantage in intro courses
- unfair assumptions of background

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Presentation Outline

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Pitfall: Self-Assessment

WARNING: GENDER-BIASED RESULTS FROM SELF-ASSESSMENT MAY BE CLOSER THAN THEY APPEAR.

survey question examples:

self-assessment: Rate your programming ability on a scale of 1 to 5...

fact: When did you first start programming?

How many high school programming courses have you taken?

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Pitfall: Overlooking Context

Context at different levels

- institution / campus
- department / major program
- course

Context's value

- generalizability of results
- cross-study synthesis of results
- factors in multi-institution study

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Context: Institution

- size, research, graduate program
- predominant culture(s)
- student demographics
- course drop policy

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Context: Department

- mentoring programs, student groups
- faculty focus on teaching, mentoring
- major entry process
- gender, persistence history

Context: Course

- gender, persistence history
- % pre-majors
- placement policy
- programming language
- programming-first, breadth-first?

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Why do students choose CS?

- comprehension of the field's breadth
- perceptions of applications, career options
- perceptions of culture

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What's unique about CS?

- reward for prior background?
- biased against contextual learners?
- potential for lucrative career? (until recently)
- faculty shortage?

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What remedies are effective?

- alternative entry paths into the major
 - different intro language, approach
 - placement by background
- adapting, studying general teaching methods
 - active learning
 - collaborative learning
- mentoring

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Interdisciplinary Effort

- education
- educational assessment
- sociology
- computer science, computer science education

Questions?

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