# A Comprehensive Support Program for Introductory CS Courses:
Improved Student Performance and Retention of Underrepresented Groups

Tia Newhall, Lisa Meeden, Andrew Danner, Ameet Soni, Frances Ruiz, Richard Wicentowski

Computer Science Department

Swarthmore College

Swarthmore, PA   USA

Identifying What to Address

Problem 1: not getting underrepresented students in the door
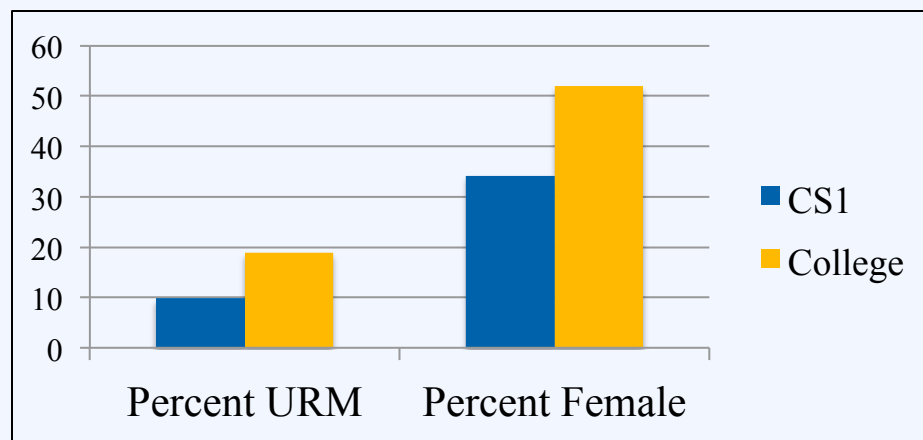
Problem 2: not retaining students from underrepresented groups at the same rate

Identifying what to Address

Problem 3: a CS culture that was not always friendly and welcoming to everyone

lab culture: nights and weekends

Problem 4: CS1 assumed a level of math preparedness

Problem 5: not always identifying students who where struggling in time

Our Goals

1. Creating a welcoming and helpful environment for students who may be intimidated by CS culture

    Increase retention, particularly underrepresented groups

2. Accommodate a wider range of backgrounds in CS1

    Serve both majors and non-majors

3. Increase support to help students succeed

Our Changes

1. To the structure of CS1
   - Python
   - Many quizzes instead of single midterm
   - Weekly lab session with professor

2. Structured Student Mentoring Program
   - Full-time coordinator
   - Course-integrated student mentors
   - Multiple student support resources
   - Focus on diversity and interaction

What Student Mentors Do

- Attend class they are mentoring
  - Hear how faculty present (consistent message)
  - Help students during in-class activities

- Run weekly evening help sessions
  - Help with lab assignments & quiz prep

- Meet weekly with coordinator and faculty
  - Receive mentoring training
  - Discuss upcoming lab goals
  - Relay information about how students doing

Choosing Student Mentors

- Diversity
  - Always at least 50% female, high % URM
  - Students see a diverse group of "CS Experts"

- Personality
  - Helpful, friendly, patient

- Retention
  - To encourage the mentors to continue in CS
  - Being a mentor increases their confidence

Student Mentor Coordinator

- Student mentor training

- Attends many classes, labs, evening sessions
  - IDs students who are struggling
  - Observes mentors for feedback & training
  - IDs potential future mentors
  - Provides feedback to faculty on teaching

- Student Support
  - Helps students during labs and evening sessions
  - Weekly office hours
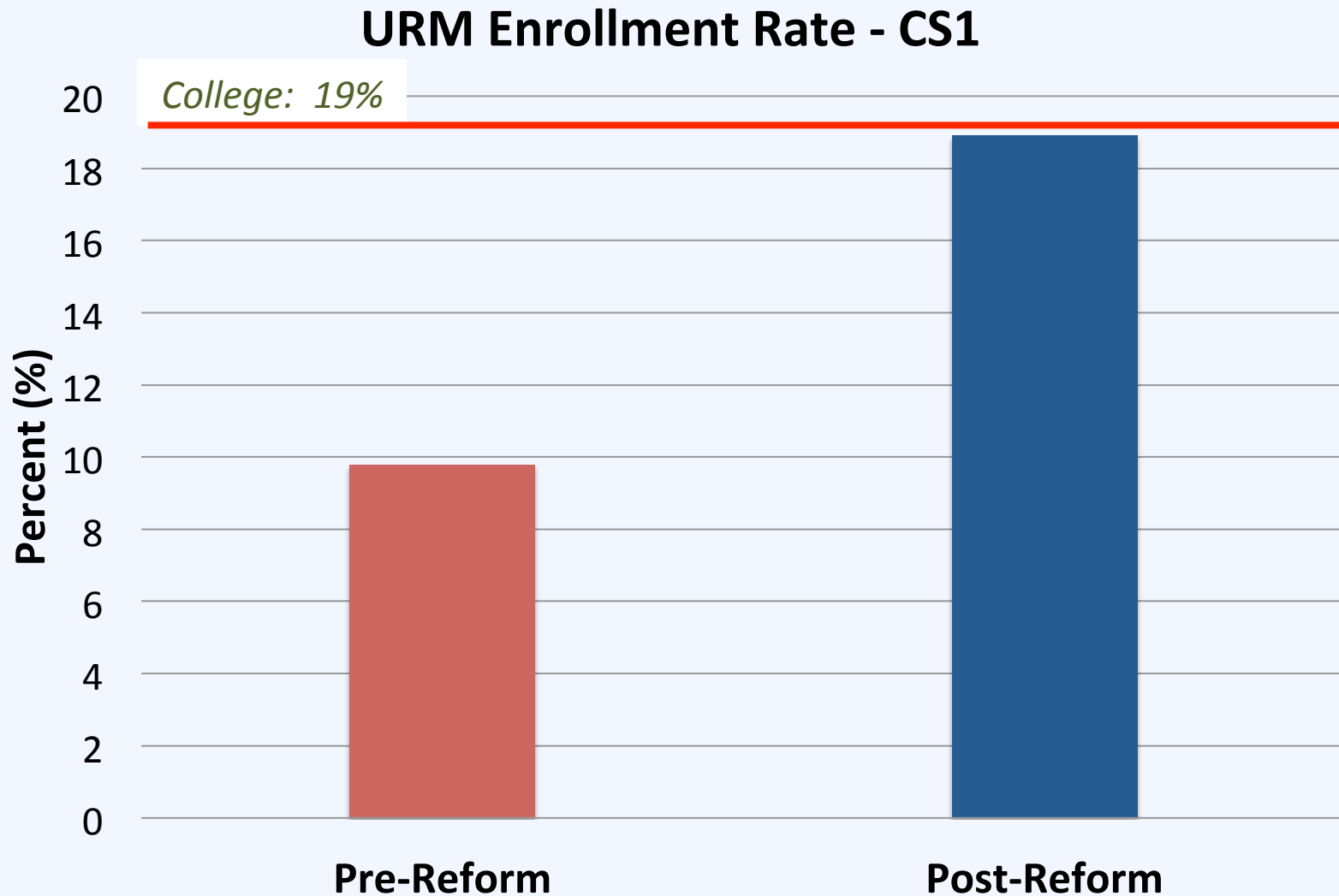 - Finds tutors

Evaluation of our Changes

Longitudinal Data Analysis
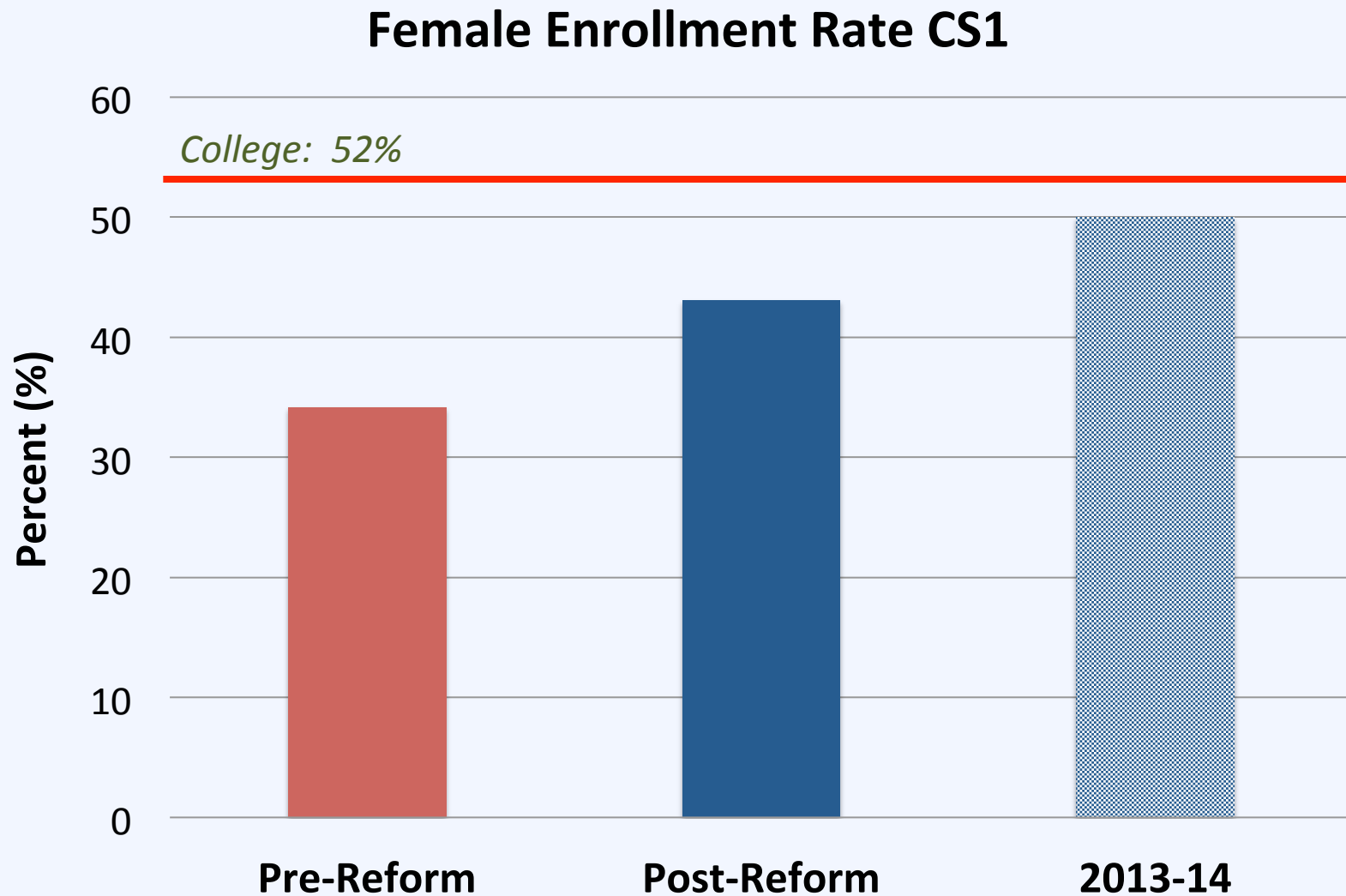
13 years of data (Fall 1999- Spring 2013)
- Data: grades, demographic, SAT, attendance
- Changes implemented starting in **Fall 2006**
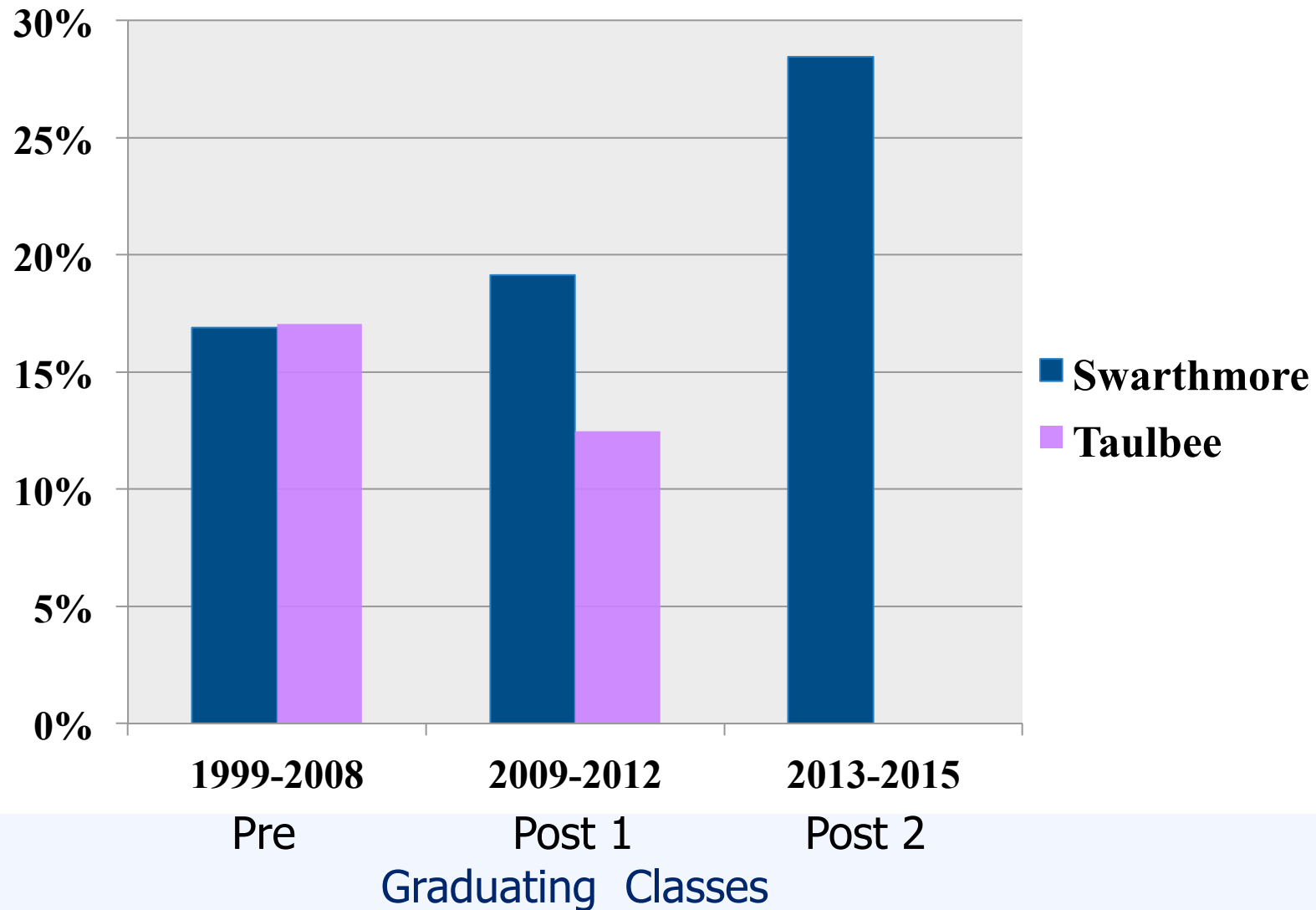
The college's IR staff carried out analysis

Results: Recruitment of URM Students

URM Enrollment Rate - CS1

Recruitment of Female Students

Female Enrollment Rate CS1

College: 52%

Percent (%)

Pre-Reform   Post-Reform   2013-14

Retention Results:
Percent Female CS Majors

Student Mentor Survey

- Administered to all current and former student mentors

- Quantitative:
  - Rate overall experience highly (4.5 out of 5)

- Qualitative:
  - Unanimously positive

Common Themes in Responses

1. Feel more a part of the department

    "Being a student mentor made me feel I was more deeply a part of the department than I had been before. I ended up getting to know more people, and feeling more connected to the department."

2. Help solidify their knowledge in CS:

    "My understanding of the [CS] material is deeper after spending time teaching it and thinking of multiple ways to explain it, particularly more abstract concepts."

Common Themes in Responses

3. A boost to their self confidence

4. A major factor in their decision to major

   "I decided to major in CS partially as a result of student mentoring. The confidence shown in me by recommending me as a student mentor made me think that I was smart enough to do computer science, and that kept me going when the course work got difficult."

Summary

- **Real Diversity Improvements**:
  - In whom we serve: future CS majors & non-majors
  - In enrollment and retention of women & URM

- **Real Change in Environment**:
  - More friendly, helpful, fun than ever
    - Evening sessions helped changed evening lab culture

- **CS1 successfully serving majors & non-majors**:
  - 50% of Swarthmore students will take a CS class
  - Support program helps success across a diverse group

- **Expanded into our 2 intermediate courses**

Applying Elsewhere

- Coordinator is essential
  - Liaison between students, faculty, mentors
  - This is a full time job

- Focused and trained student mentors a key

- Foster culture of feedback & interaction
  - Faculty, Mentors, Coordinator, Students

Added costs
  - Time: for faculty (meetings, labs, quizzes)
  - Money: coordinator salary, student mentors, food

Thank you.
Questions?