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

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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 were 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

<table>
<thead>
<tr>
<th>Percent (%)</th>
<th>Pre-Reform</th>
<th>Post-Reform</th>
</tr>
</thead>
<tbody>
<tr>
<td>College: 19%</td>
<td>10%</td>
<td>20%</td>
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Recruitment of Female Students

Female Enrollment Rate CS1

<table>
<thead>
<tr>
<th>Percent (%)</th>
<th>Pre-Reform</th>
<th>Post-Reform</th>
<th>2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>College: 52%</td>
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College: 52%
Retention Results: Percent Female CS Majors

- 1999-2008: Pre
- 2009-2012: Post 1
- 2013-2015: Post 2

Legend:
- Swarthmore
- Taulbee
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?