Revolutionizing the Culture of Computer Science

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Today’s presentation

• Need for cultural change in computer science
• Overview of the National Science Foundation’s REvolutionizing engineering and computer science Departments (RED) program
• Brief Presentations from the four current Computer Science RED Projects and their perspectives on cultural change
  • University of Texas, El Paso
  • University of North Carolina, Charlotte
  • East Carolina University
  • Boise State University
• Questions and group discussion
Need for Cultural Change in CS

• Diversity - need to create a culture more welcoming of women and underrepresented minorities
• Transform workplace culture
  • Recent high profile incidents at Uber, Google, etc.
• Prepare ethical and just CS practitioners
  • Not only for justice in the profession, but also to better represent diversity in products of computer science work
Overview of NSF’s REvolutionizing engineering and computer science Departments (RED) initiative

Two Goals:
1. Generate new knowledge for holistic professional formation across the four years of UG studies
   • Address oft-neglected “professional skill” ABET outcomes
   • Form coherent professional threads through the UG experiences, including the curriculum
2. Generate new knowledge on how to incentivize faculty development and build department cultures that support the holistic professional formation of engineers and computer scientists.

Adapted from Dr. Donna Riley, NSF, now Purdue University
What Informed the Design of the RED Solicitation?

- Past success in first year and senior year – need now to focus on middle years and technical core courses
  - Attrition is high especially in sophomore year
  - Critical entry point for transfer students
  - Need to integrate professional skills holistically across undergrad experience

- Prior research points to the following needs:
  - Faculty development
  - Faculty reward systems
  - Cultures that support faculty engagement

- Department Head leadership as a lever for change

Adapted from Dr. Donna Riley, NSF, now Purdue University
Why Revolution?

“The system needs to change, but the status quo steadfastly resists effective transformation, and change efforts to date have been inadequate, ineffective, or both.”

Dave Goldberg, BigBeacon.org
Focus of UTEP RED is to Understand & Practice Asset-Based Approaches

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<tr>
<th>NEEDS-BASED</th>
<th>ASSET-BASED</th>
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<tr>
<td>Focuses on an imposed standard and deficits</td>
<td>Focuses on existing capacity and resources</td>
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<tr>
<td>Views community members as having things done to them</td>
<td>Views community members as assets and contributors</td>
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<tr>
<td>Sees community as in need of external experts</td>
<td>Sees community as expert</td>
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Source: Kretzmann & McKnight (1993). *Building Communities from the Inside Out: A Path Toward Finding and Mobilizing a Community’s Assets*
Gauge student climate

- Classroom culture; access to resources
- Departmental experiences; involvement in opportunities
- Sense of community, identity and belonging; life demands
- Preparation for success

Engage faculty in survey development & climate analysis

- Collaborate on development of student survey
- Analyze climate results through small group discussions
- Define actions to improve

Conduct workshops

- Audience: TAs, IAs, peer leaders, students, outreach leads
- Culture and identity
- Celebration of assets
- Relate curricular and co-curricular experiences to advantages
Connected Learner Project
Goal: **Connecting students** to peers, profession and community
Through:
- Focus on **social learning** practices/active learning
- Pedagogical **design patterns** as project outputs
- Regular **climate monitoring** in college
- **Center for Education Innovation** WITHIN college
  - **Community building** focus: lunches, workshops, etc.
  - Promote / support **research on pedagogical innovation**
- **Org-Sci** specialist & **Assessment** specialist as Co-PIs
<table>
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<tr>
<th>Category</th>
<th>Description</th>
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<tr>
<td>Hiring</td>
<td>• Deploy hiring approaches/job descriptions that focus on innovation in teaching</td>
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<tr>
<td>Orienting, Training, and Professional Development</td>
<td>• Offer faculty workshops and teaching retreats on Connected Learner practices</td>
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<td>Resources</td>
<td>• Create repositories of teaching aids and materials as best practices; design patterns to facilitate innovation</td>
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<td>Mentoring</td>
<td>• Certify black belt instructors to mentor novice teachers for extra pay</td>
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<td>Incentives</td>
<td>• Provide incentives and rewards for advancing along the certification system</td>
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<tr>
<td>Feedback</td>
<td>• Use peer observations to develop faculty teaching</td>
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East Carolina University

• Transform programmers to professional software engineers.
  • Infuse professional skills development process into the entire curriculum.
  • Personalizing teaching and learning for both formal and informal settings.
  • Implement non-course-centric curriculum.
• Dramatically increase retention, persistence, and 4-year and 6-year graduation rates
  • Recruit significantly more students from underrepresented groups.
  • Work with community colleges and early college high schools in the region to increase the number of transfer students.
  • Improve participation of women in ECU computing programs.
• Three principal goals:
  a. Provide responsive support for students to learn new skills required by local industry
     • Partnership with local industry leaders to identify and offer 1-credit ‘Hatchery Unit’ courses at strategic points in the curriculum
  b. Foster a community of practice through a vertically-integrated curriculum
     • Follow *spiral-curriculum* and threading ideas through the degree
     • Lower-division students mentored by upper-division students & faculty
  c. Influence development of a *new breed of computer scientists* engaged in creating inclusive, diverse and socially just workplaces, products and society
The Computer Science Professionals (CSP) Hatchery
Boise State University

• Foundational Values Hatchery Unit
  • Introduce students to ethics and social justice
  • Build awareness of CS workplace issues
  • Introduce social contracts

• Thread ethics and social justice content through courses
  • Identify connections between ethics and social justice and technical course material
  • Use a common set of tools like teamwork assessments and language
Think-Pair-Share #1

• Think about and then discuss with a neighbor

What elements of the culture of your department do you want/need to change?
Think-Pair-Share #2

• Think about and then discuss with a neighbor

What are some of the obstacles to change you have encountered or expect to encounter?
Think-Pair-Share #3

• Think about and then discuss with a neighbor

What are strategies that you could use for overcoming resistance to cultural change?
Questions for panel members

1. How are you promoting faculty buy-in?
2. How are you promoting student buy-in?
3. Where have you met resistance to cultural transformation, and how have you overcome that resistance?
4.
Acknowledgments

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