CRA-E Workshop on Engaging Undergraduates in Research

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NSF
CRA (Computing Research Association)

– CCC (Computing Community Consortium)
– CRA-W (Women)
– CRA-E (Education)
– CERP (Evaluation)
Spoiler Alert... cra.conquer.org
Outline

• Motivation for working with undergraduates
• Benefits of working with undergraduates
• Good practices
• Funding opportunities
• Resources for students and faculty
• Q&A with panelists
Motivation

• Many undergraduates with excellent research potential have no idea what it means to do research in CS

• Some common misconceptions...
  – “I don’t want to be a professor” (< 40% of new CS Ph.D’s work in academia)
  – “I can’t afford graduate school” (tuition waivers and “good” stipends are standard)
  – “Companies don’t differentiate between B.S. and Ph.D.” (false)
Motivation

• The pipeline of domestic Ph.D. students is “brittle”...
  – 45% of Ph.D. students in the U.S. are domestic (lowest of any NSF-funded discipline)
  – Undergraduate origins of domestic Ph.D. students
    • 12 schools account for 20% of all domestic students
    • 54 schools account for 50% of all domestic students
    • 700+ schools account for the remaining 50%
Figure 7: The number of institutions with annual average productions of 15 or more, at least 10 but less than 15, at least 5 but less than 10, at least 2 but less than 5, at least 1 but less than 2

USN&WR Top 25 Liberal Arts Colleges (19/year)

Data for 2000-2010

MIT
Berkeley, CMU, Cornell
Harvard, BYU, Stanford, UT Austin, UIUC, Princeton, Michigan, UCLA
Benefits of Working with Undergraduates

• It’s a service to your department, university, and the computing community
• It’s a good way to recruit potential graduate students to your program and to help with the computing research pipeline in general
• It’s fun and gratifying for students and mentors
• It can advance your own research
• It can provide mentoring opportunities for your graduate students
Good Practices

• Academic year versus summer
• Recruiting Students
• Advising Undergraduate Researchers
• Integrating Undergrads into your Group
• Possible Pitfalls
• Beyond the research
When to do it...

• Academic year
  – Advantages
    • Provides more time to work on a project
    • Opportunity to work with graduate students
  – Disadvantages
    • Research competes with other demands
    • Students can usually only commit a few hours/week
    • You may be too busy to mentor them
When to do it...

• Summer
  – Advantages
    • Students have few other obligations
    • Intensity of activity
    • Provides a microcosm graduate student experience
  – Disadvantages
    • Students generally need to be paid (rather than get academic credit)
    • Uses your summer time
Recruiting Undergraduate Researchers

• From within your institution...
  – Model 1: Department-wide organization
    • Department-wide “show-and-tell”
    • Centralized application system
    • Centralized admissions system
  – Model 2: Individual faculty members
    • Identify students in your classes, ask colleagues for recommendations, advertise within the department
How to “advertise”

• Compelling and accessible written descriptions
• Talks to students (in class, ACM chapter, etc.)
Recruiting students

• What to look for...
  – Intellectual curiosity
  – Work ethic and tenacity
  – Academic record (but keep an open mind!)
  – Candid recommendations from colleagues
Choosing an appropriate problem

- It can challenging but...
- It should be well-defined (students usually are not ready to identify interesting or important problems)
- Some choice is good, but limit the space
- It should be accessible with the students’ limited background
- Provide >1 thing for students to work on
Group Projects
Getting started...

• Have students read a small set of background papers
• Give a “crash course” on background
• Show students how to use...
  – Library resources
  – Google scholar
  – Writing tools (e.g., LaTeX, wiki, etc.)
Setting Expectations and Goals

- Be clear about schedules/times
- Set basic and stretch goals
- Specify a mechanism for students to log and document their work
- Writing a paper is a wonderful and attainable goal!
If you have a research group...

- Integrate students into an ongoing project
- Have them work closely with a grad student
- Include them in all group activities
Co-curricular activities

• Enrichment activities
  – Talks by faculty and other researchers
  – Fun topics talks
  – Grad school talk

• Social activities (appoint a social leader if possible)

• Visits to nearby university and research labs
Funding Opportunities

• Academic year programs
  – REU supplements to NSF grants
  – CRA-W/CDC CREU Program supports teams of (mostly) underrepresented students and a professor at their institution

• Summer programs
  – NSF REU Site grants
    • three summers, ~10 students per summer, at least half non-local
    • Stipends and cost of living for students, relatively modest support for faculty mentors
  – CRA-W/CDC DREU program matches underrepresented students and faculty for research experience at mentor’s institution
    • Program has funding for students, encourages mentor matching

• Local programs at your institution
Beyond the research...

• Talk to students about...
  – Graduate school
  – What life is like as an academic or other researcher

• Show students how to...
  – Apply for graduate school
  – Ask for letters of recommendation
  – Apply for fellowships

• Offer to...
  – Read their statement of purpose essays
  – Write letters of recommendation
Resources

• Conquer! conquer.cra.org with links to
  – NCWIT REU-in-a-Box Resource
  – NSF REU sites, DREU & CREU programs, and other undergraduate research opportunities