

# National Center for Women & Information Technology

## PROMISING PRACTICES

### Affinity Research Groups (Case Study 2) Using REUs to Retain Female Undergraduates



#### Undergraduate

The Affinity Research Group model (ARG) integrates student participation in research teams and a structured cooperative learning environment. The ARG model is especially effective for reaching out to students who are competent, but who lack confidence—students who are often not invited to do research. The result is greater engagement, increased confidence, increased likelihood of pursuing a graduate degree, and the development of collaboration skills.

The components of ARG are:

- **An annual orientation.** This event helps new student members to assimilate and build research skills.
- **A research project framework.** A clear project framework and project definitions are important for helping students understand the relevance of their assignments to each other and to the research goal.
- **Defined deliverables.** Defining the outputs, assigning tasks that an undergraduate can accomplish, and setting clear deadlines allow group members to develop domain expertise while structuring individual accountability.
- **Regular meetings.** These meetings promote productive faculty-student and student-student connections. They create a structure for reporting on progress, solving problems, sharing successes, and engaging in group and self-assessment.

The foundation of the ARG model is cooperative learning, which has five elements:

- **Positive interdependence:** Establishing an environment in which students understand that they will not succeed unless all group members succeed is key. Responsibility to others within the group ensures that each member feels a sense of contribution to the success of the group and feels comfortable calling on other members for support.
- **Face-to-face promotive interaction:** Regular meetings create opportunities for sharing resources, mutual encouragement, and applauding each other's efforts to accomplish challenging research tasks.
- **Individual and group accountability:** The group as a whole and each member are held accountable for meeting project milestones. Each task is associated with a deliverable and each member is assigned responsibility for completing tasks.
- **Group and professional skills:** Because ARGs include students with varying experience levels, faculty members must explicitly teach and model interpersonal skills necessary for group work. Basic skills include active listening, active participation, and recording minutes. More advanced skills include summarizing, providing direction, synthesizing ideas, asking questions, facilitating brainstorming sessions, and offering constructive criticism.
- **Group processing:** While faculty mentors direct programmatic changes, all members are involved in discussions reflecting on the group's progress: what activities and behaviors to continue or change.

#### ARG BUILDS CONFIDENCE AND AWARENESS



**Nelly Delgado,**  
Senior Technical  
Writer for Microsoft,  
participated in an  
Affinity Research  
Group at the  
University of Texas-  
El Paso

"I don't think I would have considered grad school had it not been for ARG. We wrote papers, went to conferences, and understood what it was to do research. I knew what it meant to get a PhD or to do a master's thesis." Having been a part of an ARG as an undergraduate made her more confident in her studies when she decided to attend graduate school. In her ARG she learned that "You don't have to have the answers in order to go on. You have to be interested in the question."

Nelly points to her experience in an ARG as something that helped prepare her for her present position: "I knew I had the foundation through my education and ARG to figure out problems and then write about it in a way people could understand. You have to work with different people. It's collaborative."

*A handbook on implementing the ARG is now available from the IEEE Computer Society (Gates et al., citation below).*

#### RESOURCES

Gates, A. Q., Roach, S., Villa, E., Kephart, K., Della-Piana, C., & Della-Piana, G. (2008). *The Affinity Research Group Model: Creating and Maintaining Effective Research Teams*. IEEE Computer Society. [www.computer.org/arg](http://www.computer.org/arg)

The Cooperative Learning Center at the University of Minnesota: [www.co-operation.org](http://www.co-operation.org)

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**NCWIT offers practices for increasing and benefiting from gender diversity in IT at the K-12, undergraduate, graduate, and career levels.**

*This case study describes a research-inspired practice that may need further evaluation. Try it, and let us know your results.*

**ncwit.org** Author | Lecia Barker  
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## PROMISING PRACTICES

### How Can REUs Help Retain Female Undergraduates? with Case Study 2



#### Undergraduate

#### REUs INCREASE ENROLLMENT IN GRADUATE PROGRAMS AND RESEARCH CAREERS

Research Experiences for Undergraduates (REUs) can increase the rates at which women and under-represented minorities enter the highest levels of IT research and development. REUs lead to greater understanding of research, confidence in research skills and general mastery of the discipline, and awareness of career paths requiring an advanced degree. As a result, students become more interested in pursuing an advanced degree.

#### CRAFTING A PROJECT FOR UNDERGRADUATE SUCCESS

Student confidence and motivation to enter graduate school improve with positive research experiences. Positive REUs give students the feeling that they have made a real contribution, despite their lack of computing research background. Ideas for creating such an experience come from The University of Wisconsin's "Entering Mentoring" manual for training scientists to mentor (see URL below.) It recommends projects that:

- are multi-faceted, but with a reasonable scope for the time frame
- are feasible in relation to the student's existing skills, but also build on them
- have built-in difficulties that will be faced after the student has developed some confidence
- generate data or analysis that the student can present orally or in writing
- go *beyond* cookbook experiments or free programming labor

Faculty and graduate mentors should talk to students about their skills and interests, mentor them about scientific inquiry, and establish clear expectations for project outcomes.

#### NSF REU SUPPLEMENTS: AN EASY WAY TO SUPPORT A BUDDING RESEARCHER AND FUTURE COLLEAGUE

The National Science Foundation makes it easy to support an undergraduate researcher. You can ask for a supplement for almost any NSF grant – or one held by a colleague – to support an undergraduate researcher with a substantial stipend. Ask your program officer for details.

#### HOW CAN YOU SHOW UNDERGRADUATES THE BENEFITS OF A RESEARCH CAREER IN COMPUTING?

When advertising REU opportunities, it's helpful to know what motivates students to get involved. For example, many students participate in REUs because they want help in making career decisions; these students also are more likely to consider an advanced degree as a viable option, according to research by SRI International. A valuable tool for communicating the benefits of a research career is a slide show entitled, "Why choose a Ph.D. in CS?" available on the Computing Research Association's website: [www.cra.org/highlights/student.html](http://www.cra.org/highlights/student.html).

#### RESOURCES

- Barker, L. (2009). Student and faculty perceptions of undergraduate research experiences in computing. *ACM Transactions on Computing Education*, 9(1) Article 5.
- Hunter, A.-B., Laursen, S.L. & Seymour, E. (2006, February). *The Benefits and Costs of Faculty Engagement in Undergraduate Research and their Sources*. Presented by Elaine Seymour at the conference To Think and Act Like a Scientist: The Roles of Inquiry, Research, and Technology in the Precollege and College Years, Texas Tech University, Lubbock, TX.
- Russell, S. (2005). *Evaluation of NSF Support for Undergraduate Research Opportunities. 2003 NSF-Program Participant Survey: Final Report* (SRI International). Available at [www.sri.com/policy/csted/reports/university/index.html#uro](http://www.sri.com/policy/csted/reports/university/index.html#uro).

#### MODELS AND ELEMENTS OF A POSITIVE RESEARCH EXPERIENCE

Whether part of a formal program or a special opportunity for individual students, REUs can take several forms. For example, summer experiences can take place at another institution or on a student's own campus, where the social and academic setting is familiar. Academic-year experiences can occur as part of, or in addition to, the regular course load. Many faculty advisors bring undergraduates into their labs to work with their graduate students.

No matter what the model, certain components help motivate students to enroll in an advanced degree program:

- A collegial, supportive relationship with the faculty advisor and/or graduate mentor
- A large amount of time spent on research
- Clear communication of students' readiness and outcome goals (e.g., presentation of results) from the outset, making students feel well-prepared
- Student independence increases as the research process progresses

Students also are more likely to apply to graduate school when their research experience includes guidance on choosing a graduate program, writing a strong application, and setting expectations for the graduate experience and research careers.

NCWIT offers practices for increasing and benefiting from gender diversity in IT at the K-12, undergraduate, graduate, and career levels.

Visit [ncwit.org/practices](http://ncwit.org/practices) to find out more.

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