Undergraduate Research as a Pedagogical Approach for Increasing Student Engagement and Learning

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Council on Undergraduate Research (CUR)

www.cur.org

- A **national organization** of individual (> 3,300) and institutional members (> 600) representing all disciplines and over 900 institutions of all types.
- The **mission** of the CUR is to support and promote high-quality undergraduate student-faculty collaborative research, scholarship, and creative activity.

CUR Resources
Faculty & Institutions

MEETINGS	SERVICES
National Conferences	Consulting Service
CUR Dialogues	Mentor Network
Institutes	Grant Preview Service
Regional Workshops	CUR Fellows Awards
Posters on the Hill	Listservs
	Advocacy

PUBLICATIONS

CUR Quarterly "How To" Series Specialized Volumes

Aspirational Definition of UGR

Undergraduate research, scholarship, and creative activity is an inquiry or investigation conducted by an undergraduate in collaboration with a faculty mentor that makes an original, intellectual or creative contribution to the discipline.

Regional Workshop Program
OVERVIEW

- CCLI award to expand CUR's successful model of an annual, national-level "Institutionalizing Undergraduate Research" workshop using a regional approach.
- Regional workshops are designed for institutions that do not have a tradition or culture of campus-wide engagement in undergraduate research.
- All types of institutions are invited to apply to send an institutional team to attend one of the regional workshops.
- 8 workshops offered around the United States in 2007 & 2008, serving 64 institutions.

Regional Workshop Program
GOALS

- Provide teams with information on the status and national landscape of undergraduate research.
- Assist teams in formulating ideas and a vision for undergraduate research on their campuses.
- Assist teams in generating goals related to undergraduate research that they can bring back to their campuses.
- Provide robust follow-up experiences between CUR and each campus.
- Build relationships among the campuses in the region.

REGIONAL WORKSHOP PROGRAM

WORKSHOP DESIGN

The workshop design was deliberately chosen to increase the likelihood for sustained change at institutions:

- Multi-day format involving team participation (4-member teams, including an administrator)
- Expert facilitators
- Plenary presentations and breakout discussions
- Personal interactions and networking
- Subsequent follow-up and monitoring

REGIONAL WORKSHOP PROGRAM

IMMEDIATE OUTCOMES

Each institutional team leaves the workshop with:

1. A customized and action-oriented plan to institute an undergraduate research program on their own campus.
2. A network of regional colleagues to support their efforts
   - workshop facilitators
   - CUR members at neighboring institutions
   - fellow workshop participants
3. Support for faculty development through additional CUR programs, services, and meetings.

REGIONAL WORKSHOP PROGRAM

FOLLOW-UP ACTIVITIES – OVERVIEW

- Continuing facilitator-team interactions.
- Site visits to participant institutions.
- Networking and interactions with the broader undergraduate research community.

REGIONAL WORKSHOP PROGRAM

FOLLOW-UP ACTIVITIES – GOALS

- Foster continuing and expanded interactions among workshop participants.
- Provide support during implementation of campus plans to facilitate sustainability.
- Establish a community of faculty and administrators that share a mutual interest in undergraduate research.

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National Science Foundation
WHERE DISCOVERIES BEGIN

DISCUSSION QUESTIONS

- How can we best build a "community of scholars" to foster a campus culture of undergraduate research?
- How can research and research-like experiences be best incorporated in the classroom environment?
- What are the challenges of institutionalizing undergraduate research? What are successful strategies for overcoming these challenges?

Undergraduate Research as a Pedagogical Approach for Increasing Student Engagement and Learning

Workshop Leaders:
Nancy Hensel – Executive Officer, Council on Undergraduate Research (CUR)
Jeffrey Osborn – Dean of the School of Science, The College of New Jersey; CUR President
Kerry Karukstis – Professor of Chemistry, Harvey Mudd College; CUR Immediate Past-President

Question 1: How can we best build a "community of scholars" to foster a campus culture of undergraduate research?

Scenario: Midwest College recently sent a team to a CUR NSF-CCLI Regional Workshop to learn how to institutionalize undergraduate research. Three faculty members and one administrator attended the workshop where they developed a draft strategic plan for implementing undergraduate research across the campus. The campus places a high value on teaching and mentoring of students and provides modest support of faculty research. Team members understand that they will need to think about how to get students involved, how to get faculty engaged, and how to obtain administrative and financial support. Upon returning to campus, the first task is to develop strategies for encouraging a community of scholars on campus.

Essential Questions (some examples)	Strategies for Success
What are the characteristics that we want to define our students (e.g., comfortable with ambiguity, inquisitive) and faculty (e.g., ability to integrate teaching and research)? How do we shift our campus culture to envision faculty as "teacher-scholars" and students as "student-scholars?"	
How can we convey a strong sense of inquiry and an understanding of how knowledge is acquired in the disciplines into the campus culture?	
How do we recognize and reward faculty and students for deeply engaging in undergraduate research?	
How can we foster STEM-wide and campus-wide conversations about the nature of undergraduate research across the disciplines?	

Question 2: How can research and research-like experiences be best incorporated in the classroom environment?

Scenario: Majors in a particular STEM department at University X complete their degree with a two-semester senior research project earning six units of credit. This two-semester course culminates in a thesis and oral presentation in a university-wide venue. This requirement was chosen by the faculty members in the department to address the curricular goal of offering majors a quality research experience so that the undergraduates may understand the ways in which new scientific knowledge is created. Six learning objectives are associated with this goal:

Undergraduate Research Learning Objectives
1. Students will demonstrate that they can independently find and use information pertinent to their research efforts.
2. Students will demonstrate an understanding of the relationship of their research project to the current literature.
3. Students will demonstrate that they can design and execute an experiment to test a hypothesis or answer a specific question.
4. Students will demonstrate that they can analyze experimental results, draw appropriate conclusions, and suggest next steps.
5. Students will demonstrate that they can effectively communicate the findings of their work in oral, visual, and written form.
6. Students will master and apply an experimental or theoretical technique at a level beyond that presented in the introductory curriculum.

Question: While this department has embraced research as a valued part of an undergraduate curriculum, the faculty members recognize that the most successful and satisfying research experiences will be those where students have had opportunities to develop critical research skills early in their undergraduate curriculum. A "research-supportive" curriculum can be established in many different ways. What practices and strategies might be implemented by the faculty and the institution to create a curriculum that prepares students to undertake their senior research with the greatest degree of success? Your consideration might include how to implement these strategies at different levels, such as: (a) pedagogical approaches, class exercises, and out-of-class assignments in a single course, in a departmental requirement, or institution-wide "core" experience; (b) strategies to develop particular skills or vertical integration of content throughout the entire major curriculum; (c) selection of required courses outside the department or co-curricular experiences; (d) institutional infrastructure that facilitates the development of research-supportive curricula; and (e) administrative perspectives that encourage the development of a research culture.

Undergraduate Research Learning Objectives (some examples)	**Strategies/Mechanisms to Address Learning Objective Prior to Senior Research Experience**	
	Level (e.g., course, dept., etc.)	**Example**
1. Students will demonstrate that they can independently find and use information pertinent to their research efforts.		
2. Students will demonstrate an understanding of the relationship of their research project to the current literature.		
3. Students will demonstrate that they can design and execute an experiment to test a hypothesis or answer a specific question.		
4. Students will demonstrate that they can analyze experimental results, draw appropriate conclusions, and suggest next steps.		
5. Students will demonstrate that they can effectively communicate the findings of their work in oral, visual, and written form.		
6. Students will master and apply an experimental or theoretical technique at a level beyond that presented in the introductory curriculum.		
Other objectives:		

Question 3: What are the challenges of institutionalizing undergraduate research? What are successful strategies for overcoming the challenges?

Challenges (some examples)	Strategies for Success
Will students have time and/or desire to engage in undergraduate research? Which students should be involved in undergraduate research (e.g., all, honors only, etc.)?	
How can we include undergraduate research within the normal faculty workload? What are the issues related to reappointment, tenure, and promotion?	
How will an undergraduate research program be funded? What can be done at no cost or low cost to support and build undergraduate research? What investments will be required (short-, medium-, and long-term)? For faculty? For equipment? For facilities? For student support?	
What institutional leadership is required? What role should campus administration play in supporting undergraduate research? How can we build faculty leadership capacity?	
What campus offices outside of academics might be involved in supporting undergraduate research (e.g., Grants Office, Development Office, Student Affairs, Student Government, etc.)?	