

Designing Undergraduate Research Experiences: A Multiplicity of Options

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The Importance of Design

Undergraduate research experiences are a rich mechanism for meeting student, faculty and institutional goals. Successful research experiences take a wide variety of forms. To guide choices in design, it is essential to know what you are trying to accomplish. What are your goals? A good design then takes into account the resources available to meet these goals

Potential Project Goals

For students:

- Applying classroom learning to a research problem
- Testing interest in geoscience careers
- Exploring what it is like to do science
- Job skills: technical, communication, collaboration
- Self-confidence or adventure

For faculty:

- Exploring a new research area
- Publishable research
- Collaboration with students, community, or scientists

For institutions:

- A high visibility program for honors students
- New connections to industry or local communities
- Professional development opportunities for faculty

Drawn in part from: Broadly Defined Goals for Undergraduate Research Projects: A Basis for Program Evaluation, CUR Quarterly, December 1997

What Are Your Resources?

- Who are your students? What are their strengths? goals?
- What research facilities or field sites are available?
- Who are your natural collaborators?
- What funding is available or obtainable?



Making Choices in Line with Goals and Resources

Selections from the examples below can be combined in a wide variety of ways. Tips for success: Students must be well prepared for the research experience. Structure the experience to move students through intermediate goals to project completion. Anticipate student needs for emotional, financial, technical and academic support. Strong communications can overcome many design flaws.

Defining the Problem

Successful Approaches to Creating Ownership

- Guiding students who define a project of their own conception
- Introducing an overarching problem and offering students a choice of possible projects
- Students and faculty work together as a team defining group priorities for research
- Faculty member recruits student to work on a specific project

Things to Consider

- Are students prepared to define a doable, interesting problem?
- Is there sufficient time/staff to provide adequate guidance?
- How important is defining the problem to your learning goals?
- Will the project selection meet your research goals?

Developing the Research Plan

Successful Approaches Leading to Good Project Design

- A proposal writing and review cycle
- Constraining the techniques or approaches for use
- Providing a standard protocol for data collection

Things to Consider

- Does the research plan development process lead to plans that are a wise use of available resources? Are the costs in lab time, faculty time, supplies, in line with the benefits to student learning? The value of the research result?
- Does the research plan development process serve student learning goals? Do the plans themselves result in learning experiences in line with goals? For example, if job skills are a goal, are the skills developed of high interest to employers?
- Does the process maximize the experience for all students in the program? Do all students end up with sound projects?

Collecting and Interpreting Data

Successful Approaches for Supporting Good Experiences

- On-going structured reporting through oral or written presentations
- Informal presentation and discussion via team meetings
- Continuous one-on-one mentoring
- Student collaboration as a support mechanism
- Checkpoints

Things to Consider

- What is the correct balance between supporting the student and allowing them to grow into an independent scientist? How does the program support variations in this balance point from student to student?
- Do students have the tools they need to successfully recognize good data and to interpret it? Do they know enough about data reduction? presentation? statistics?
- What happens if the research plan needs to be adapted after an early result?
- Can bottlenecks or points of high failure in the data collection process be anticipated or eased to reduce frustration?

Communicating Results

Successful Approaches that Enable Discussion and Closure

- In-class or research group presentations
- Participate in on-campus or national research fairs
- Submission to professional society meetings
- Presentation to community group
- Web site discussed by internet group
- Student paper reviewed by students or scientists

Things to Consider

- What support do the students need to be successful in their presentations? Do they need guidelines? coaching? examples?
- What presentation venue is most appropriate to the group? What will be meaningful to the students? Where will they be challenged but not overwhelmed? Are different venues needed for different students?
- How will debate occur? What is an appropriate audience? How will discussion take place and be moderated?