

# Developing Strong Geoscience Programs and Departments

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## Our Approach

Strong geoscience programs are essential for preparing future geoscientists and developing a broad public understanding of our science. The challenges of creating a strong program can be most effectively met using a team approach that involves all faculty within the department or program and capitalizes on the strengths of every department member. Involvement of students in the process is valuable.

Workshops sponsored by Project Kaleidoscope (www.pkal.org) on various aspects of departmental planning in the geosciences were offered in the summers of 2001 and 2002. The workshops emphasized the importance of designing programs in the context of both departmental and student goals.

**Well-articulated goals form a foundation for designing curriculum, courses, and other departmental activities.**

## Important Components of Strong Programs

A full departmental program extends beyond courses and curriculum. Studies in physics (National Task Force on Undergraduate Physics, Hilborne, 2002) indicate the importance of the following:

- recruiting able students
- mentoring students
- providing courses appropriate for pre-service K-12 teachers
- assisting with professional development for a diversity of careers
- providing undergraduate research opportunities
- making connections with local industries and businesses that employ graduates

## Developing a Coherent Curriculum Based on Learning Goals

Course/skill matrices have emerged as particularly valuable tools for analyzing how individual courses combine in a curriculum to meet learning goals. Integrated programs where students have opportunities to learn and use skills in multiple contexts have been developed at several institutions. Departments are leveraging synergies between courses to more effectively reach departmental goals and capitalize on opportunities in the larger campus environment.

**Matrix Approach** (used at Carleton College and College of William and Mary). This example is from Mary Savina, Carleton College, who first developed the approach.

- Articulate goals and objectives - what should your students know and be able to do by the time they graduate?
- Develop a matrix of skills and courses and fill in the matrix
- Discuss the resulting matrix and make changes in courses, as appropriate

Courses→ Skills↓	intro	intro	geomorph	tect	paleo	min	pet
General skills							
Computer skills							
Field skills							
Lab skills							
Interpretive skills							

General skills: writing, speaking, quantitative reasoning, information literacy, critical thinking, working in groups, 3-D concepts

### Benefits of Matrix Approach

- Graphic representation of actual curricular experiences
- Can be used to identify gaps
- Repetition used for reinforcement
- Effective in curricula with different structures
- Ensures that students have opportunities to practice skills required for senior research

→ **A more coherent program**

**Threads: an alternate planning approach** (used at Pomona College, Eric Grosfils and Linda Reinen)

Faculty identify **central threads** that they think should permeate the curriculum and to use these as a way to link together courses and the collective education of students (e.g., research, quantitative and computational reasoning, and field experiences.)

## Undergraduate Research and Research across the Departmental Curriculum

PKAL workshop participants have articulated a wide variety of approaches to undergraduate research opportunities within and outside courses based on their departmental goals, faculty goals, and resources.

- Research experiences in one or more courses throughout the curriculum (library research, field and/or laboratory research; individual, small-group, or class research projects, one-time or continuing projects).
- Research methods courses
- Independent research and thesis work involving large and small groups or one-on-one faculty mentoring.

## Advising and Mentoring Students for the Future

Mentoring and advising activities are becoming more central to many departmental programs and can effectively draw on campus, alumni, and industry resources. PKAL workshop presenters and participants have identified a variety of advising and mentoring strategies. These include

- Departmental e-mail lists for announcements
- Externship and shadowing programs
- On-campus presentations by alumni and representatives from local agencies
- Undergraduate research opportunities and internships
- Opportunities for students to give presentations (e.g., at departmental brownbag seminars)
- Opportunity for students to teach (e.g., as undergraduate teaching assistants, in departmental outreach programs such as William and Mary's Geology on Wheels program, in which geology students given presentations to local elementary school classes)
- Departmental newsletter with information about alumni and careers
- Electronic introductions of majors and alumni
- Departmental or program advising newsletter (Laura Guertin, Penn State Delaware County)
- Web site of career choices and possibilities (Laura Guertin)

## Issues at the Campus Level

### Interdisciplinary and other campus-wide programs

Departments have a wide variety of strategies for developing productive synergies with campus-wide programs including those emphasizing writing skills, quantitative skills, and environmental studies.

### Role and reputation of the department

Attention to the role and reputation of the department on campus is important in creating a supportive climate for departmental activities.

### Best practices for implementing and assessing change

Motivation is a critical factor in making changes. A clear understanding of stakeholder needs and goals and assessment information that describes the results of current or proposed situations are strong starting points for creating a motivating case for changes.

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- Michael Savarese, Florida Gulf Coast University