



For Higher Ed

SERC's Portal to Resources
for Faculty, Departments and Institutions

Drawing Diverse Students into your Class

John McDaris, Science Education Resources Center, Carleton College
Cathy Manduca, Science Education Resource Center, Carleton College

Featured Websites



InTeGrate

*Interdisciplinary Teaching about Earth
for a Sustainable Future*



SAGE 2YC

*Supporting and Advancing
Geoscience Education in
Two-year Colleges*



Building Strong Geoscience Departments

On the Cutting Edge



SUPPORTING STEM SUCCESS IN A LIBERAL ARTS CONTEXT



On the Cutting Edge

Strong Undergraduate Geoscience Teaching



Some Key Practices

- Reach Out to K12 Students and Teachers
- Partner with Community Colleges
- Prioritize Introductory Courses
- Use Field Experiences
- Communicate Career Opportunities
- Involve Students in Research Experiences

Reach Out to K12 Students and Teachers



Supporting Minority Students in Geoscience at JSU

Related Links
[Geosciences at JSU](#)

Part of the [Recruiting and supporting minority students in STEM disciplines](#) Collection.
Information for this profile comes from the [Jackson State University](#) website and an interview with Quinton Williams, Professor of Physics and former Department Head, on July 24, 2013.

Jump down to [Context](#) | [Keys to Success](#) | [Attracting New Students](#) | [Supporting Our Majors](#) | [Preparing Students for Careers](#) | [Additional Information](#)

Jackson State University

Context

Jackson State University is a Historically Black University with almost all of the enrollment is African-American. Science, and Geoscience offers BS degrees in Physics,

Keys to Success

- [Attracting new students](#) to the program and thinking outside traditional recruitment
- [Supporting majors](#) through creating a program recognizing the gaps that their students face
- [Preparing students for careers](#) by making the program relevant to their future

Attracting New Students

Partnering with their national Alumni Association. The programs. Alumni who are parents often want their children to be available with a geoscience degree. This partnership to major in the department have come via this pathway

Partnership with Penn State University. This partnership with Jackson State's Earth System Science program are eligible for a degree program. The partnership is supported by NSF

Providing Cultural and Regional Relevance to Issues of Global Sustainability

Mercer University

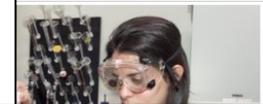
Mercer University's Penfield College and Tift College of Education are collaborating to improve Earth literacy among their students and among Georgia's in-service teachers. Mercer serves non-traditional, return-to-college students ("adult learners") who are invested in their communities through their family, work, and community service. Consequently, these learners bring unique opportunities for learning about Earth in the university setting.

To increase the Earth literacy of these students and increase their interest in addressing the societal issues of sustainability, we are developing virtual field trips to sites in Georgia and the southeastern USA to include in existing InTeGrate modules. To begin this process, we have implemented existing InTeGrate modules in Penfield College's undergraduate courses and in a Tift College of Education pre-service teacher preparation course. In Summer 2015, we developed materials for a virtual field trip to Providence Canyon, Georgia to align with "A Growing Concern" InTeGrate module.

Earth literacy currently is not an area of emphasis in K-12 classrooms, due in large part to the diminished emphasis in state standards. Pre-service and in-service teachers often lack understanding of Earth literacy or appreciation for the importance of Earth systems and there is little to motivate them to change this. Through our existing collaborative relationship with school systems in Georgia, we will offer professional development using InTeGrate modules and include the virtual field trip component to encourage teachers to develop Earth literacy and active interest in sustainability issues in their own students. By offering professional development opportunities to in-service teachers based on InTeGrate modules and the virtual field trips, combined with age appropriate materials to be used in K-12 classrooms, we expect to increase Earth literacy among the students these teachers serve.

Description of Successful End State

development, from kindergarten teachers with content and professional development opportunities have utilized to broaden access to geoscience.



Successfully navigating Providence Canyon, GA, a human-made erosional feature caused by poor land management practices that started in the early 1800s and enhanced through a tenant farmer system.

Prioritize Introductory Courses

Defining Heads and Chairs Degree Programs Make a Case Connect to Future Professional Prep Student Recruitment

Building Strong Geoscience Departments
On the Cutting Edge

Cutting Edge > Strong Geoscience Departments > Student Recruitment

Teaching Introductory Geoscience Courses

Do you recall your first geoscience course? For many geoscience teachers, it was this first taste of plate tectonics, landforms, fossils or oceanography that suddenly made us realize we had found our calling. We hope that some of today's new students who experience their first earth science courses will become inspired just like we did. Yet some students take a 100-level geology course because it seems to be the least-daunting way through their college's science requirement. Thus, faculty of introductory courses have a big job on their hands, managing a wide range of students, taking them through the basics of earth science, and hopefully imparting some inspiration along the way.

Jump down to: [Course Design & Pedagogy](#) | [Resource Collections](#) | [Special Topics](#) | [Workshops & Events](#) | [Get Involved](#)

Related Links

- [Starting Point: Teaching Introductory Geoscience](#)
- [Preparing Teachers to Teach Earth Science](#)
- [Teaching the Process of Science](#)
- [Building Strong Geoscience Departments - Curriculum](#)

Cutting Edge

- Develop Program-Wide Abilities
- Strong Geoscience Departments
- Defining Strong Departments
- Professional Preparation
- Student Recruitment**
- Recruitment Strategies
- Videos about Recruitment Strategies
- Introductory Classes**
- Career Opportunities
- Beyond the Classroom
- Advertise
- Assess Your Efforts
- Recruitment Posters
- Meeting Sessions
- About BSGD

Capitalize

An increasing body of students is driving them away from the major. One problem is that introductory geoscience courses are nothing but lecture away, not only from the major, but also from the major. Given that student interest in a STEM major, it is important to consider the effect, department



Designing an Effective Introductory Course



1. Set goals

Learn how to set [effective course goals](#) from the Course Design [Tutorial](#). This tutorial will help you articulate your course constraints and overarching goals. Browse [course descriptions and syllabi](#) to get a sense of how others have taught their Intro classes.

2. Consider assessment options

Aligning your assessment strategies with the goals of your course is an essential part of the design process. You can learn more about assessment in the section about [Assessing Student Learning](#) in the Course Design Tutorial and through our module on [Observing and Assessing Student Learning](#).

3. Select pedagogies and specific teaching activities

The **pedagogic techniques** highlighted below can provide inspiration as you consider various approaches that will help you achieve your course goals. The **resource collections** are organized to provide a rich set of materials to draw from in constructing the specific set of learning experiences you want for your students. Finally, explore the more in-depth information and ideas available in **special topics**.

Selected Pedagogical Approaches to Addressing Challenges in Introductory Geology

- [Teaching Large Classes](#): An extensive collection including information on active learning pedagogies for large classrooms, assessment techniques, and example course descriptions and syllabi.
- [Managing Multi-Section Courses](#): Resources on how to effectively coordinate multiple sections, work with TAs



Starting Point: Teaching Introductory Geoscience »

The Starting Point project has developed an array of modules on particular teaching methods that are effective in teaching introductory geoscience classes. There is a discussion of what each technique is, why you might want to use it, and how to do so combined with a collection of teaching activities that make use of it.

Partner with Community Colleges

Support Geoscience Transfer Students

Compiled by Karen Layou (J Sargeant Reynolds Community College) and [John McDaris](#) (Science Education Resource Center). In addition to other resources, this site draws on discussion by participants at the [2012 Preparing Students in Two-year Colleges for Geoscience Degrees and Careers Workshop](#).

Many students enroll at two-year colleges (2YC) as a cost-effective and flexible way to pursue higher education. Some students begin their studies with the intent of completing



[Learn More](#)

University of Texas El Paso - Broadening Access to the Earth Sciences Across The El Paso Higher Education Community

[Learn More](#)

Stanford University - MSI and 2YC Teaching Program

Angelina Sanderson Bellamy, Program Director - Office of Multicultural Affairs,
Stanford School of Earth, Energy and Environmental Sciences
Tenea Nelson, Assistant Dean - Office of Multicultural Affairs, Stanford
School of Earth, Energy and Environmental Sciences

Summary

The InTeGrate program at Stanford is a partnership between the Stanford School of Earth, Energy and Environmental Sciences and STEM faculty at local two-year colleges (2YCs) and minority serving institutions (MSIs). The primary objective of the program is to recruit and increase the retention of underrepresented minorities within the STEM disciplines at all levels of academia. In doing this, we also hoped to add to the retention and satisfaction in particular of URM graduate students and postdocs to our School and the professoriate. We worked towards these objectives in two ways:

- Exposing undergraduate students in general science or early geoscience courses to geoscience modules that address global sustainability issues, thus making the topic more accessible and relevant for URM students.
- Creating the opportunity for URM postdoctoral and advanced graduate students to teach these modules in classrooms at our partner institutions.

Program Goals:

1. [Improve our recruitment efforts of underrepresented minorities and other groups to geoscience graduate programs.](#)
2. [Strengthen collaborative associations with local MSI and 2YCs.](#)
3. [Provide professional development, training in teaching and pedagogy, and mentoring support to postdocs and graduate students who may not otherwise have the opportunity to teach, or teach at MSI/2YC institutions while enrolled or working at Stanford.](#)
4. [Continue to give MSIs/2YCs the ability to build their capacity to integrate geoscience teaching through our modules into their courses.](#)

Use Field Experiences

Teaching Geoscience in the Field

Field experiences are a critical part of a geoscience student's education and have long been one of the foundations of geoscience education. Field experiences aid students in applying knowledge they learn in class to the real world as well as help in developing skills in critical thinking, techniques, and instrumentation. The role of field instruction in the geosciences curriculum must address new expectations for undergraduate student contemporary logistical challenges.

Jump Down To: [Field Skills and Habits of Mind](#) | [Developing Field Skills Involved](#)



2YC Students in the Field

This page presents perspectives on and resources for engaging 2YC students in field experiences - opportunities, challenges, benefits. Essays from 2YC faculty showcase different examples of using fieldwork in 2YC courses while teaching activities demonstrate particular things that have been effective in this context. These materials have been developed by two-year college faculty in a number of settings for several different projects.

[Using in the Field](#) across the

The Place of Fieldwork in the Profession

What role does geoscience education play in the continued development of geoscience (based on...)

Benefits

What are the benefits of fieldwork? This compilation attributes...

Development

Where and how do we design field experiences? There are many ways we design...

Design

This design...

Collaborate to Heighten Awareness, Rejuvenate, and Train: CHARTing a course to bring Environmental Justice to the coast

We seek to develop a pathway by which students from diverse majors would be prepared to address current and future issues regarding resource limitation, natural hazards, and environmental justice with an interdisciplinary perspective and with focus on our coastal environment.

Description of Successful End State

At the conclusion of this activity, we expect the introduction and use of approximately six (6) InTeGrate Modules in-part or fully across three (3) courses. The target courses are one existing course, Environmental Issues, and two new cross-listed University by the Sea courses: Environmental Justice in Coastal Systems and Coastal Community Risk Management. Each of these three courses targets the broader University community, bringing interaction between science and non-science majors to discuss and address coastal hazard and environmental justice issues.

Early Indicators

The chemistry within our leadership team and the willingness of the larger team (leadership plus partners) to work collaboratively, making concessions where needed and being willing to offer constructive suggestions and criticism, show promise for expedient development of the necessary curriculum and procedures to accomplish the goals of this project.

Program Activities

The stepwise integration will start with Environmental Issues in the 2015-16 AY, followed by course development for the University by the Sea two-course series in Summer 2016 and deployment in Fall 2016. We plan to measure the degree to which (number of module sections) InTeGrate materials are used, degree of satisfaction for the students and instructional personnel with the course activities and materials, and compliance with the goals of Affordable Learning Georgia, which aims to reduce the cost of educational materials used in course instruction.

In addition to the implementation of InTeGrate materials into the new and existing courses, we will seek the development of a Coastal Risk and Environmental Justice Certificate program that will award the successful completion of the two new courses, which include cooperative service...



2YC-Field Teaching Activities

[Browse all Teaching Activities](#)

[How to be a field geologist: an in-class exercise to introduce students basic outcrop analysis](#)

by Lisa Walker, Mt San Antonio College
This in-class exercise is designed to give students practice analyzing outcrops before they go on a field trip. First, students watch a short video tutorial on analyzing an outcrop. Then, they are given a color...

[Introduction to the Black Canyon City Landslide](#)

by Debra Kraft, Mesa Community College
During this one day field trip, students will be exposed to some general introductory field methods by examining an active landslide. They will examine the relative ages of the materials involved as well as identify the types of materials involved...



Communicate Career Opportunities

Provide Career Information



What Do Geoscientists Do? An Overview

People with geoscience expertise can be found in many parts of the workforce. This page lays out information about what geoscientists do, what kinds of preparation are necessary, and what the earning potential is in various parts of the geoscience workforce.

Internships

Internships offer opportunities for students to get a taste of what it's like to work as a geoscientist. They also offer opportunities for departments and employers to forge mutually beneficial relationships. These pages on internship programs were developed as a result of discussions at the 2007 workshop on [the Role of Departments in Preparing Future Geoscience Professionals](#).



Undergraduate Research in Geoscience at Northern Virginia Community College

Author Profile

Information for this profile was provided by Shelley Jaye, Geology.

Departmental/Institutional Context

Northern Virginia Community College (NOVA) is the largest educational institution in Virginia and the second-largest community college in the United States, comprising of more than 75,000 students and 2,600 faculty and staff members. NOVA is also one of the most internationally diverse colleges in the United States, with a student body consisting of individuals from more than 180 countries. Located near Washington, D.C., the College includes six campuses along with four educational centers. NOVA offers more than 160 degrees at the associate's level and certificate programs. We also offer distance learning programs through our Extended Learning Institute and continuing education courses through Workforce Development.

The geoscience program at NOVA is large and robust. We have eight full-time faculty spread across our four largest campuses. I am located on our Annandale, VA campus which is NOVA's largest campus. We currently have three full-time geoscience faculty and five adjunct professors. We teach a variety of geoscience courses including introductory Physical and Historical Geology, Oceanography, Mineralogy, and, Environmental Geology. We offer an array of specialty classes, such as Snowball Earth and the National History and Environment of the Chesapeake Bay, as well as a large assortment of one credit field trip courses and longer, weekend, one- and two-week field courses in various locations in the US and Canada.

Research Program Description

The NOVA geosciences department regularly offers a comparable and transferable course in Mineralogy that includes a strong optical component. NOVA has a well-established relationship with the US Geological Survey headquartered in nearby Reston, VA. The Survey



Partnerships work best when all parties
can provide explanations about how to do

at the national level.



Involve Students in Research Experiences

Undergraduate Research with 2YC Students

Compiled by [John McDaris](#) of SERC.

Undergraduate Research as Teaching Practice

Undergraduate research is an exciting way to introduce students to the scientific method and to engage them in critical thinking and problem solving skills. Research can also increase relevance of the topics at hand and pave the way for students to transition from novices to experts. In the geosciences, there are a plethora of field, laboratory, and computational research experiences that can be employed from the introductory to upper

Research
in Class
within the
Curriculum

These ben
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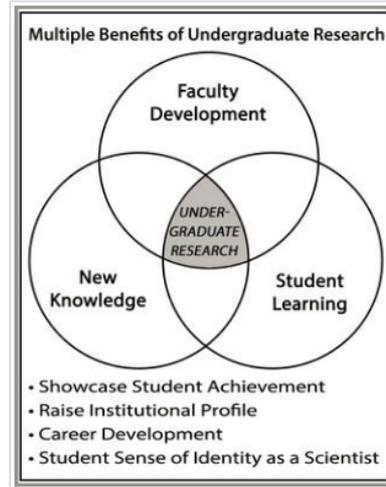
Involving
Profess

DEVELOPING INQUIRY SKILLS

Inquiry skills can be infused throughout a curriculum, and can be organized to benefit both student and faculty mentor. The incentive to teach research skills that emerges among faculty from a mentored research program is also an important driver of curricular innovation. Faculty effort required for teaching research skills may seem to be a trade-off against faculty time for pursuing research, but in most successful cases faculty scholarship and student learning are synergistic: students can make meaningful contributions to research, and student learning outcomes are increased in inquiry-driven courses. A large proportion of scholarly publications by faculty at Capstone Institutions include student coauthors.

[What Do We Mean by "Inquiry" »](#)

[Capstone Institution Profiles »](#)



ce courses.

Create an Inquiry-Rich Curriculum

An inquiry-rich curriculum incorporates elements of research at any stage of student development. An inquiry-rich curriculum structure may be linear or iterative, but a key goal is to expose students to scientific problem-solving processes. Often this helps prepare students for research experiences outside of a credit-bearing course. For some programs, the research-driven curriculum is viewed as an effective means of teaching the discipline and efficiently reaching large numbers of students. A range of strategies may be pursued, from teaching stand-alone skills (i.e. looking at a figure from the primary literature) to offering open-ended lab modules to implementing full project-based courses.

Grow an Undergraduate Research Program

Undergraduate research experiences following the apprenticeship model allow students to dedicate time to completing an entire, authentic research experience from inception to publication or to helping with a project at some point along the way *with the understanding of all of the components for completion*. These experiences support an important set of student outcomes related to cognitive, career, and skills development. Critical to success are design of a complete experience, strong mentoring, and linking the specific experience to participants' course work and to a more general understanding of the nature of scientific research, including the collaborative nature of the scientific community.

Find Resources to Support Student Inquiry

Supporting student inquiry can be done at multiple levels and at multiple cost points. Sometimes, resources are found by shifting priorities. The most successful programs provide resources and time for faculty development and curricular revisions and also feature faculty research projects that are adaptable in ways that benefit

Thank you!

<http://serc.carleton.edu/integrate/>

<http://serc.carleton.edu/sage2yc/>

<http://serc.carleton.edu/NAGTWorkshops/departments/>

<http://serc.carleton.edu/liberalarts/>

<http://serc.carleton.edu/NAGTWorkshops>