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Recruiting Students into the Earth Sciences through Undergraduate Research

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CUR Focus

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Recruiting Undergraduates into the Earth Sciences Through Research

Many individuals and organizations have discussed the challenges of recruiting students into the STEM (science, technology, engineering, and mathematics) disciplines and retaining them once they arrive (Seymour and Hewitt 2000, including references). In the Earth sciences, we face a particular challenge in attracting students to become majors. Despite the inclusion of Earth and space science in the National Science Education Standards (NRC 1996) and in 49 of 50 state standards (AGI 2005), Earth science courses (such as physical geology) are not offered at most public high schools. In California, for example, Earth science does not fulfill the laboratory science requirement for admission to the University of California, and at least partly in consequence, only 3 percent of high school students enrolled in an Earth science course in the 1999-2000 academic year (AGI 2002, 2005). This is not unique to California, and few students arrive at college aware of the Earth sciences as a potential course of study.

In addition to a lack of familiarity with the content of Earth sciences, students often enter college with a view of science that is biased towards experimentation (Ibrahim, Buffler, and Lubben 2009). As a result, non-experimental science (sometimes described as "historical") is perceived as less rigorous or less reliable (Cleland 2001). Although some Earth scientists do conduct experiments, the majority use different, equally valid scientific methods such as description and modeling, and use a different language to describe their work that can be unrecognizable as science to the uninitiated (Dodick, Argamon, and Chase 2009). Students who enter college with a strong interest in science or engineering are more likely to be drawn toward the more familiar experimental sciences; Earth sciences are perceived as less appealing if they are encountered at all.

Nonetheless, the unique methods used by geoscientists generate fundamental knowledge about the Earth that is critical to facing our biggest socio-scientific challenges today (Frodeman 1995), including understanding and adapting to climate change, mitigating the effects of natural hazards, and ensuring the availability of clean drinking water and energy. While these are topics that interest incoming students at Stanford, these students typically expect to approach these issues through engineering or other science majors. In annual surveys of the approximately 1,600 freshmen who have entered Stanford each year since 2004, 10 or fewer each year listed a major in Earth sciences as their first choice. Biology and engineering topped the list every year with around 160 to 200 students indicating that those fields would be their first choice as a major. Effective recruitment of students into Earth science majors, therefore, must first make students aware of the existence and breadth of subdisciplines within Earth science and then educate students about the nature of Earth science research, explaining how the research methods may differ from those of other sciences but are equally rigorous.

Overcoming these unique and pervasive problems requires multiple strategies. We have expanded and revised our introductory course offerings to include more hands-on activities and engagement with real data, which has resulted in increased enrollments (Egger 2005; Egger 2009). In addition, we have developed an undergraduate research program that targets primarily freshmen and sophomores, a strategy advocated by the authors of a broad study about the benefits of undergraduate research (Russell, Hancock, and McCullough 2007). At a research-oriented university like Stanford, bringing undergraduates into the culture of research is now common practice, but it comes with its own problems, primarily arising from the fact that students have very limited backgrounds in the subject material. In disciplines where students likely had coursework in high school, such as biology or chemistry, this limitation may be easy to overcome, but often their Earth science knowledge is minimal. In order to successfully bring early career students into Earth science research, therefore, strong mentoring and guidance must be in place, along with projects that allow students to utilize the skills they already have and apply them to questions about the Earth.

In the following we briefly review the history of undergraduate research at Stanford University in general and that in Earth sciences in particular to provide the context for our program. We then describe the undergraduate research pro-

gram in the School of Earth Sciences (SES) in detail and use the numbers of program alumni deciding to major in Earth science as a measure of whether we are achieving our stated goal, "to attract students to major or minor in the Earth sciences and/or complete advanced research in one of the departments or programs within the school."

Undergraduate Research at Stanford

Stanford has a long history of research: The first PhD was awarded in 1894, only three years after the university was founded. Individual faculty members have consistently involved undergraduates in their research, often through their own funding, although the historical record is lacking. The Undergraduate Research Opportunities Office opened in the 1970s and by 1996 was funding approximately 300 student research projects a year, primarily senior thesis research in the humanities (Delgado 2006). With the opening of the Office of the Vice Provost for Undergraduate Education (VPUE) in 1995, a number of new programs to support undergraduate research were established. From 2000 to 2005, Stanford raised $1.1 billion to provide permanent funding for these programs (Delgado 2006). Most relevant is the VPUE's Departmental Research Grant Program, started in 2001, which solicits proposals to fund undergraduate research within Stanford's departments, programs, and institutes.

As shown in Table 1, during the 2009-2010 academic year, the VPUE spent approximately $4 million for 1,062 undergraduates to conduct research through all of the programs that it funds (Stanford University 2010). Based on the data in Table 1, we assume that, in any given year, approximately one of every six students is involved in a research experience funded by the VPUE. That proportion underestimates the true extent of undergraduate involvement in research, however, since it does not include research experiences supported by outside funding. In the School of Earth Sciences, this support includes industry and NSF grants to individual faculty members, as well as NSF REU (Research Experience for Undergraduates) programs managed by consortia such as IRIS (Incorporated Research Institutions for Seismology) and SCEC (Southern California Earthquake Center). Regardless of the exact numbers, however, undergraduate research is clearly a well-established and well-supported part of the undergraduate experience at Stanford.

Table 1. Undergraduate Research Participation at Stanford

Academic year	Students funded through VPUE**	Total UG enrollment	Percentage of enrolled students funded through VPUE to do research
2009-10*	1062	6878	15.4
2008-09	1165	6812	17.1
2007-08	1188	6759	17.6
2006-07	1150	6689	17.2

* 2009-10 funding is about 10% below previous years due to budget cuts.

** VPUE is Vice Provost for Undergraduate Education, numbers based on B. Thomas, pers. comm., 2011.

Undergraduate Research in the School of Earth Sciences

Undergraduate research in Earth sciences at Stanford has long history. John Branner, a geologist, was the first professor hired by university founder Leland Stanford, and Branner later become the university's second president. The geology department was one of the original departments in the university. Branner established the Stanford Geological Survey in 1893. As part of this survey, every summer groups of undergraduates majoring in geology conducted field work in a part of California or Nevada that had not previously been mapped geologically. Although field camp is a common component of undergraduate geology programs, most involve mapping in well-understood locations to teach students research skills. Branner set a precedent of involving undergraduates in original research, and the Stanford Geological Survey continued until 1995, when declining enrollments made the program too costly to sustain. However, faculty members continue to involve individual students in field research projects in accordance with this tradition.

Today, the School of Earth Sciences (SES) consists of four departments and two interdepartmental programs as shown in Table 2. The three departments and one program that grant undergradu-

Table 2. Departments and Programs in the School of Earth Sciences

	DEGREES			STUDENTS (AS OF MARCH 2011)	
DEPARTMENTS	BS	MS	PhD	Majors	Minors
Energy Resources Engineering	x	x	x	10	0
Environmental Earth System Science		x	x	n/a	n/a
Geological and Environmental Sciences	x	x	x	13	4
Geophysics*	x	x	x	1	0
INTERDEPARTMENTAL PROGRAMS					
Earth Systems	x	x		142	n/a
Emmett Interdisciplinary Graduate Program in the Environment and Resources (E-IPER)	x	x	n/a	n/a	n/a
* Geophysics is undergoing major curricular revisions in 2010-2011, and numbers may not reflect long-term trends.					

ate degrees are the focus of our undergraduate recruiting efforts. The school's Undergraduate Research Program has evolved over the past ten years. In 2002, the Department of Geological and Environmental Sciences (GES) was awarded a departmental research grant to fund six student projects; all of the students were declared GES majors, and four of six projects were field research projects in the tradition of the field camp. The program grew in funding, number of students involved, and the diversity of projects over the next four years, although the primary audience remained undergraduates already declared in the major.

In 2006, GES and the Department of Geophysics received separate departmental research grants, resulting in a total of 24 students funded to conduct research, including a large number of freshmen and sophomores (see Figure 1). This increase in total numbers and in the involvement of students earlier in their careers prompted a variety of changes to the program, including a more substantial Research Preparation course during the spring quarter and a Research Presentation seminar in the fall quarter following the research experience. That same year, the Department of Energy Resources Engineering began to revive its undergraduate program, and thus became interested in recruiting undergraduates through research as well. The following year, 2007, marked the first year when the School of Earth Sciences submitted a single departmental research grant proposal, and the undergraduate research program took on its current form. Despite variations due to funding levels, we succeed in engaging about 25 undergraduates each year in our research program.

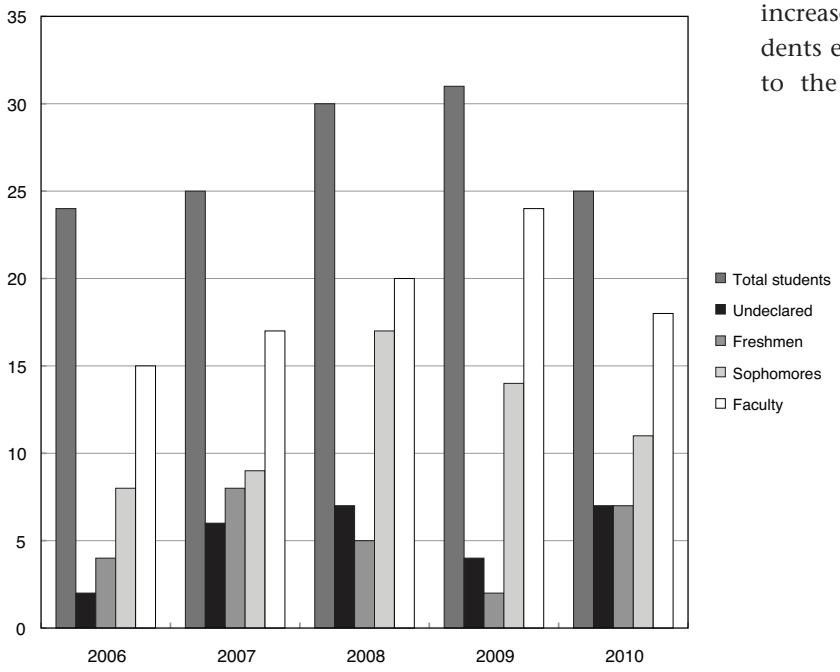


Figure 1. Student and Faculty Involvement in the School of Earth Sciences Undergraduate Research Program (2006 numbers are aggregated GES and Geophysics numbers; from 2007 on, a single SES program existed).

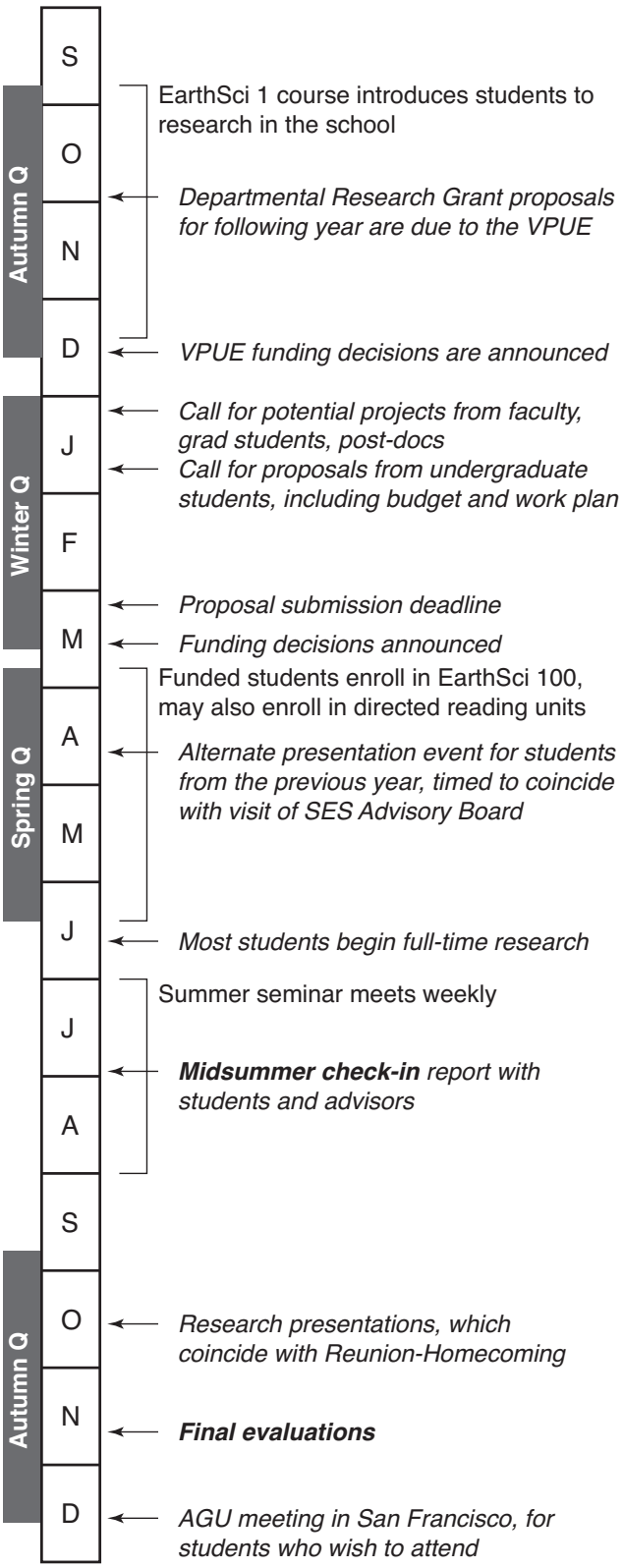


FIGURE 2. Timeline Showing Major Components of the School of Earth Sciences Summer Undergraduate Research Program.

Research as Recruitment

The principal aim of the SES research program is to provide undergraduates the opportunity to work on a strongly mentored yet individualized research project, in order to build and strengthen our community of undergraduate researchers within the school. In particular, we seek to engage students early in their academic careers in order to allow them to explore one aspect of the Earth sciences in depth, while also learning about the diversity of ideas available for study within the school. We have four goals for the program:

- To provide a challenging and rewarding research experience for undergraduates at all levels who wish to explore the Earth sciences, not limited by departmental boundaries;
- To foster interdisciplinary study in the Earth sciences among the undergraduate population;
- To attract students to major or minor in the Earth sciences and/or complete advanced research in one of the departments or programs within the school;
- To build a sense of community among students who share a common interest in developing a deeper understanding of the Earth.

The program provides students with an authentic research experience, from proposal writing to presentation of results (see timeline in Figure 2). It is run primarily by the school's undergraduate program coordinator with support from faculty in all of the departments. Students are responsible for contacting a potential advisor and working with the advisor to develop a feasible research project; the students then submit a scientific proposal that includes a budget and timeline. If funded, students agree to conduct the research and present their results. To facilitate the development of a community despite their individualized projects, students participate in a research preparation seminar during spring quarter and a summer lunchtime seminar.

Most of the research program's components, shown in Figure 2, are familiar and are frequently used in research programs for juniors and seniors (Russell, Hancock, and McCullough 2007). Bringing freshmen and sophomores into research presents challenges for both the students and the advisors, however. The students, for example, require guidance that goes beyond providing content knowledge, and this can be

a time-consuming process and prone to misunderstandings. We have developed several activities to overcome these challenges, including two academic-year seminar courses, a summer seminar, and presentation opportunities.

EarthSci 1: Current Research in the School of Earth Sciences

The first challenge in recruiting freshmen and sophomores into the Earth sciences is informing them about our majors and research opportunities. Introductory courses offered in Earth sciences in the fall include labs or discussion sections and are four- or five-unit courses, a significant time commitment for students. Because freshmen have a series of required courses, they often don't have room to take an introductory course outside their anticipated major. A new course, EarthSci 1: Current Research in the School of Earth Sciences, was developed to address that problem. It is a one-unit course offered during fall quarter (see Figure 2), providing an opportunity for students to see, without a large workload, the kinds of things they could study in Earth Sciences.

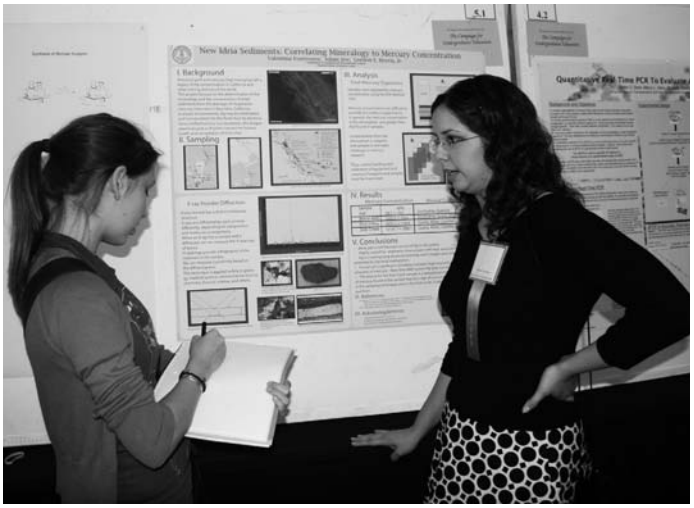
Each week, a faculty member from the School of Earth Sciences presents his or her research in a talk geared toward students with little or no background in the area. Faculty lecturers are drawn from all four departments in the school. Students submit short written responses to the lectures; these responses are passed on to the lecturer, who then responds to any questions that came up. Students are also required to attend either the Symposium for Undergraduate Research and Public Service or the SES Undergraduate Research Symposium and talk to peers who received funding from the department program the previous summer concerning the research they conducted.

Student evaluations of EarthSci 1 have been very positive. In responding to a question about the written responses, students wrote:

> [The assignments were] good to get us thinking about what the speakers did and whether we would consider that field.

> I appreciated that the assignments allowed me to discuss my view of the speaker and how their major fits into my passions.

About the course in general, students wrote:



An undergraduate researcher talking to a student in EarthSci 1 at Stanford's Symposium for Undergraduate Research and Public Service (SURPS) in 2006. Visiting the poster session and talking to presenters is a required assignment for students in EarthSci 1; and making a poster presentation is a requirement for students receiving funding through our SES Undergraduate Research Program.

> This was an extremely informative course. I appreciated that it gave me a slight view into the subject matter of each major.

> I thought it served its purpose well. It gave me a general understanding of the Earth Sciences and has exposed me to a wide range of fields.

Importantly, EarthSci 1 is not a burden for faculty. The course is organized and facilitated by the undergraduate program coordinator, who also guides the faculty in developing a presentation that targets the appropriate audience, includes information about the courses they teach and what students who work with them have done, and how they got where they are today. In general, the faculty members have enjoyed the opportunity to talk to a group of students who are intelligent and motivated and who bring different interests and experiences to the classroom.

Since 2007, enrollment in this course has been around 20 students each fall quarter, even though the course does not count as an elective unit for any majors in SES. Each year three or four students who took the course apply to do research. A large majority of the 20+ students who enroll each fall go on to take additional classes and major in one of the SES programs.

EarthSci 100: Research Preparation

EarthSci 100 is a required spring quarter seminar for students who will have their first research experience in the School of Earth Sciences over the following summer (see Figure 2). It is also a one-unit course, since many students are already tightly scheduled. We list three goals for the course in the syllabus:

- To introduce students to (or reinforce their knowledge of) the process of scientific research;
- To prepare students to have a successful summer research experience; and
- To build an active community of researchers within the school.

Seminar-style discussions and presentations, coupled with short written assignments, help us achieve these goals.

As we've noted, students often arrive at college with little awareness of the subject matter of Earth science. In addition, they often have a confused and limited understanding of the nature and process of science itself (Moss, Abrams, and Robb 2001). Decades of research have shown that, in order to address misconceptions, time must be devoted to explicit instruction in the process of science (Lederman 2007). We engage students in discussion in response to several readings that come from a set of freely available, online modules that cover the process of science (available at http://www.visionlearning.com). Students read about multiple research methods, scientific ethics, and ways to use the scientific literature, among other topics. Our classroom discussions take these general scientific concepts and focus on how the concepts are manifested in the many sub-disciplines of the Earth sciences. These discussions also introduce the culture of research at Stanford.

To prepare students to be successful in their summer research, we have developed a series of assignments that facilitate interactions with their advisor(s) to help build their background knowledge and develop a feasible work plan for the summer. For example, students read an online module about reading scientific journal articles (Carpi, Egger, and Kuldell 2008), schedule a meeting with their advisor to get a key paper from them to read, and then read the paper and submit a summary to us. They also rewrite their initial proposal, focusing on developing a more detailed plan of work for the summer.

Finally, we take advantage of several opportunities to build a sense of community, both among the students as a cohort and as members of the larger SES community. Several weeks of the course consist of students presenting their research plans to their peers. Their peers ask questions about the research and give feedback on the quality of the presentations, establishing a precedent for constructive criticism. In addition, we require students in EarthSci 100 to attend the SES Research Review, a poster session where graduate and undergraduate students from the school present their work, and talk to three undergraduates who conducted research the previous summer.

In final evaluations of the entire program, which we began using in 2009, we asked students to rate the various components. Students generally rated all aspects of the program "worthwhile" or "very worthwhile" (ratings from 2009 are shown in Figure 3). We used a new survey tool in 2010 and our response rate was much lower and not all data were saved, but 10 out of 12 student respondents rated EarthSci 100 as "worthwhile" or "very worthwhile." As Figure 3 shows, this is an improvement over the response in 2009, when five of 16 students had a "neutral" response to the course. Fortunately, the additional comments provided by these students helped us revise the course to include more interaction and substantial feedback. Course-specific evaluations from spring 2010 included the following comments:

> Readings were interesting and easy to process. Liked the anecdotes within them! Some of them had good tips, too.
>
> The final presentation really helped me clarify the work I will be doing this summer, which was good.
>
> [I] definitely feel more prepared for the summer.
>
> [T]he course was interesting and definitely did its job preparing me for research this summer. Overall, I wasn't looking forward to the class, but in retrospect, it was a necessary portion of the process.
>
> I gained a lot from this class; some skills I found particularly helpful were how to read scientific articles and how to interact with my mentor. I definitely feel more prepared for going into the

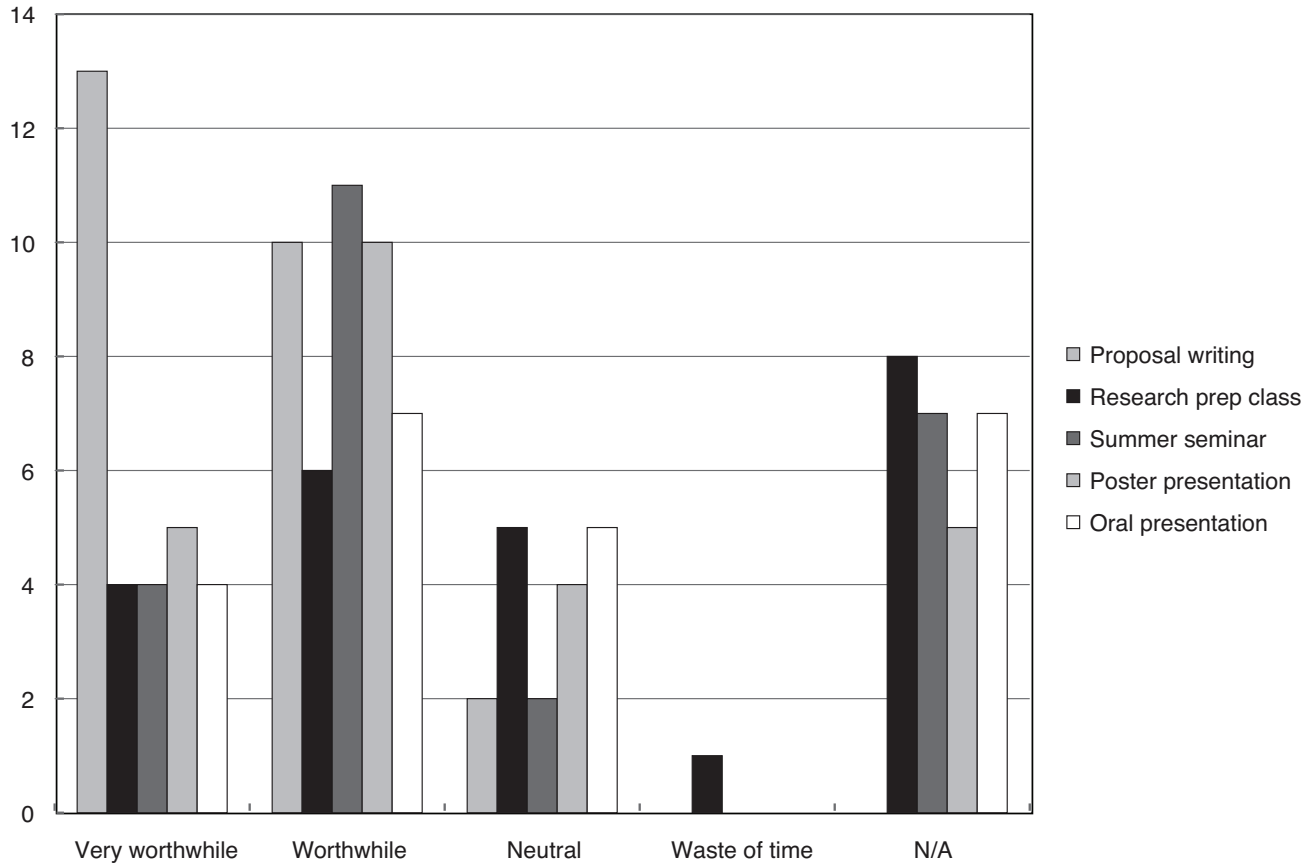


FIGURE 4. Ratings of Program Components. Data are from 2009 only; a new online survey tool was used in 2010 and not all data were saved. N/A corresponds to students who did not participate in a particular activity; for example some students whose research takes them off-campus during the summer do not participate in our summer seminar.

> field this summer, and I know what resources I should turn to if I have any questions.

A goal for the course that is not stated in the syllabus is to ease the advising burden by giving students some tips for communicating with their advisors and getting started in the research process. We have not specifically asked for feedback about the course from faculty advisors, but several volunteered comments in the midsummer and final evaluations:

> I think the spring quarter pre-summer research seminar was very productive as the students seem to have an excellent sense for what is expected and required of them. They started the projects quickly and have continued to make very good progress.

> This is a great program and helps a lot in attracting very young people to science and scientific ways of thinking.

Summer Seminar

During the summer, students are primarily working with their individual mentors, often as part of a research group that includes graduate students and post-docs. Some are in the field and away from campus for all or part of the summer, but a majority of funded students are doing research on campus. We bring our students together with students from related programs, including students at the Woods Institute for the Environment and students working on individual faculty members' grants, for a weekly seminar and lunch. At this seminar, faculty mentors from SES and Woods give talks that are followed by lunch, where students can continue conversing with the speaker and the program directors can check on student progress in a casual, informal setting. Near

the end of the summer, the seminar includes workshops on poster making and giving effective oral presentations to help students prepare for the fall presentations.

The primary purpose of this seminar is to build on the sense of community among the students that began to develop in the spring. Given the diversity of topics that their research covers, we seek to help students feel as though they are a part of the School of Earth Sciences. That community provides some relief from the isolation that some students feel as they work on their projects, as well as a safety net should any problems arise. Students have responded very strongly to this, and a large majority finds it "worthwhile" or "very worthwhile" (see Figure 3).

Presentation Opportunities

As noted above, students enrolled in EarthSci 1 and EarthSci 100 are required to attend sessions where students funded in previous years present their research. This serves three purposes. First, they are talking with their peers about research rather than with graduate students or faculty, which makes Earth science research more accessible. Second, they see what a finished product (or a work in progress) looks like and get a better sense of how to structure their own project. Finally, these sessions help build a sense of community within SES that goes beyond a single cohort of students.

In addition, we are able to connect these students to the professional Earth science community beyond Stanford. We are fortunate that the largest Earth science professional meeting, the fall meeting of the American Geophysical Union (AGU), is held every December in San Francisco, only 35 miles away and easily accessible by public transportation. We do not require students to attend, but we ensure that undergraduates who wish to attend are not discouraged from doing so by having to pay their own registration fees. For those who attend, the exposure to the larger Earth sciences community is an energizing experience that gets students excited about where their research experience can take them.

Program Evaluations from Mentors

We have used a variety of ways to solicit feedback from the faculty, graduate students, and post-docs who mentor SES undergraduates in their research projects. From 2006 to 2009, we asked for informal, non-anonymous feedback through email during the summer research process. The primary purpose of this feedback was to see if there were any red flags or problems that needed to be addressed. Starting in 2010, we also sought anonymous, open-response feedback through a survey tool at the end of the program. As noted, the new survey tool resulted in some data loss, but we have responses from 12 of 18 mentors.

In response to the question "Did the work done by your student(s) match your expectations?", nine mentors responded that their undergraduates met or exceeded their expectations for the research. Some mentors reported challenges in working with their students, including time management, personal issues, and developing students' independence. Yet all but one of the mentors reported that he or she would continue to work with the student(s) into the academic year, despite the fact that the funding had ended. One faculty mentor commented, "I was not prepared for how much undergraduates need to learn to come up to speed." Yet that same mentor reported that the student "exceeded my expectations." All reported that they would work with undergraduate researchers again in the future; several volunteered that they felt they could do so because they felt very well supported by the program.

Are We Successfully Recruiting Students?

It is easy to point to specific components of the program and say that they are working well. The question remains whether the program as a whole is succeeding in its goal of attracting students to major in one of the departments and programs within Earth sciences.

Unfortunately, we have few examples to serve as models or benchmarks for success. Broad-based studies about the benefits of undergraduate research such as those by Lopatto (2009) ignore Earth science entirely, limiting analysis to the disciplines of biology, chemistry, physics, mathematics, computer science, and engineering. Russell et al. (2007) surveyed participants and mentors in NSF-funded REU programs and included "environmental science" as a category, but this term is not uniformly applied and may or may not include Earth science, depending on the institution. The lack of geoscience or Earth science is especially curious in this study, as the Geosciences division within NSF supports numerous large-scale, long-term REU projects. Similarly,

Table 3. Undeclared Students' Choice of Majors after Research Experience

Year	Undeclared when applied	DECLARED MAJOR AFTER RESEARCH EXPERIENCE					
		GES Major	GP Major	ERE Major	Earth Systems Major	Added minor in any SES program	Percentage of undeclared who declared SES major
2006	2	2					100%
2007	6	1	1		2	3	67%
2008	7				5	1	71%
2009	4					2	0%
2010	7	5 students still undecided					

Seymour et al. (2004) refers to only one paper on undergraduate experiences in geoscience (Manduca 1997).

And yet, we have established that Earth sciences face unique challenges in bringing undergraduates into research, especially early in their academic careers. We have collected some data to help us determine if our program is overcoming these challenges. When students submit their proposals to the research program, they enter some basic demographic data, including their major and/or minor. We therefore have a record of students' majors prior to participating in research. We have then tracked these students to determine what major or minor they declared after their research experience. The largest group of students we fund are sophomores who are recently declared one of the four majors within SES (see Figure 1); the second largest group is undeclared freshmen and sophomores. To focus on recruitment, we look in more detail at the fate of the undeclared students during and after the research experience (see Table 3).

Other than in 2009, a majority of the students who had not chosen a major but who applied to the program eventually chose to major in an Earth science program. A small number of students from other majors added a minor (primarily in GES), as noted in Table 3. While the numbers are small, they scale to the number of students currently declared as majors or minors in each of the school's programs (see Table 1).

We attribute the low percentage of students who declared Earth science majors after participating in research in 2009 to two factors, First, we had a smaller number not only of undeclared students than in previous years, but also of freshmen and sophomores in general, so most of the students had already declared majors in the Earth sciences. Second, with small numbers, we would expect this level of variability from year to year. The students who take a minor are usually majoring in something like computer science and have participated in a research project that allowed them to apply their skills to a question about the Earth.

An important factor for sustaining the program is that the number of faculty members who have mentored undergraduates in research has grown every year, aside from a program-wide decline in 2009-2010 due to budget cuts (see Figure 1). We take this as a strong indication that the emphasis on engaging freshmen and sophomores has not been an undue burden on the faculty and/or that our mentoring of the undergraduates through the research preparation class and the summer seminars provides sufficient additional resources to mitigate the efforts required of individual faculty members.

Conclusion

We are strongly encouraged by the growth in the number of students that we have been able to fund even as the total number of students funded by the vice provost's office decreased, as well as by the small but steady stream of students who choose to major or minor in our programs after conducting research. We also are encouraged by our ability to attract students from other majors to apply their skills to research projects in the Earth sciences and by widespread faculty support for the program, especially given the challenges of engaging freshmen and sophomores in research. The feedback we have received from students and faculty indicate that our strategies for introducing students to the

diversity, rigor, and community feel of the Earth sciences are working.

We are fortunate that undergraduate research is well supported by resources at Stanford, but it also is important to note that the courses that facilitate recruitment of freshmen and sophomores into research are highly effective and low-cost, requiring minimal investment of time by any one individual.

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Anne E. Egger is an assistant professor of geological sciences and science education at Central Washington University. Previously she was the undergraduate program coordinator for the School of Earth Sciences at Stanford University. She is senior editor of Visionlearning, a project that develops modular text resources for teaching science and makes them available for free on the web (http://www.visionlearning.com) and has written a variety of texts for introductory geoscience and for teaching the process of science. The focus of her research is regional geology and tectonics, combining field observations with geochronological and geophysical methods to decipher the long-term history of tectonically active regions. She has been a councilor in CUR's Geoscience Division since 2010.

Simon L. Klemperer is a professor of geophysics at Stanford University and also directs the geophysics undergraduate program. In 2008, he was awarded the Allan V. Cox Medal for excellence in fostering undergraduate research. He studies the growth, tectonic evolution, and deformation of the continents, primarily using controlled seismic sources.

General Criteria —

The *CUR Quarterly* publishes articles relating to all aspects of undergraduate research that are of interest to a broad readership. Articles regarding the effects of the research experience on the development and subsequent endeavors of students, and how to initiate, support, or sustain undergraduate research programs are appropriate for this journal. The *CUR Quarterly* is not the appropriate venue for publishing results of undergraduate research.

Editorial Policies —

The *CUR Quarterly* is the voice of members of the Council on Undergraduate Research. All articles are peer-reviewed. Editorial judgment regarding publication of manuscripts and letters rests with the Editors. Concerns about editorial policies and decisions should be addressed to the Editors.

Manuscripts

How to Submit —

Articles should be submitted for review to the Editor-in-Chief as email attachments. Authors are encouraged to discuss disciplinary articles with the appropriate Division Editor prior to submission. Contact information for all Editors is listed at the front of every issue of the *CUR Quarterly*.

What to Include —

• Copy of article (MS Word or compatible format, Times font, 12-point, double-spaced, 1 inch margins, and single-spacing between sentences). 2000-3500 words is the typical length of an article, but longer or shorter articles may be appropriate for certain topics.

• Key words for indexing (up to 10).

• Personal information

— Institutional title, mailing and email addresses for the corresponding author.

— Biographical sketch for each author (4-6 sentences).

• Proper Citations. Refer to the *Chicago Manual of Style* citation guidelines-author-date style (http://www.chicagomanualofstyle.org/tools_citatioguide.html).

For more detailed submission instructions visit: http://www.cur.org/Publications/Quarterlies.html

Book Reviews

The CUR Quarterly publishes short reviews of books and other new publications the editors deem of interest to the undergraduate research community. Books or other publications will be reviewed within 12 months of publication. The Book Review Editor will select appropriate titles for review and solicit reviewers. In order to ensure that the reviews are as timely as possible, the Book Review Editor will expect to receive finished reviews within two months of assignment. Each printed issue of the *CUR Quarterly* will include one review.

Suggested titles for review and book reviews should be submitted via email to:

Book Review Editor
Ami Ahern-Rindell
ahernrin@up.edu

CUR Comments

The *CUR Quarterly* will consider scholarly commentaries on issues vital to the health and vigor of the undergraduate research enterprise from readers for publication. *CUR Comments* should be limited to 250 words, and must be on topics relevant to CUR's mission. *CUR Comments* will be published at the sole discretion of the Editors and will be edited if necessary, the writer will be shown the edited version for her/his approval.

Undergraduate Research Highlights

Highlights consist of brief descriptions of recent (past six months) peer-reviewed research or scholarly publications in scholarly journals. These publications must be in print and must include one or more undergraduate co-authors.

Submissions need to include:

• Title of the article and full journal citation (inclusive pages).

• A brief description (3-5 lines) of the research and its significance.

• Title and department or program affiliation of the faculty member.

• A brief description of the student co-author(s). Include the year of study in which the student(s) undertook the work, the opportunity through which the work was undertaken, (independent study project, summer project, REU program, senior thesis project, etc.), and the current status of the student (graduate school, employed, still enrolled, etc).

• The source of funding for the work.

Questions contact:

Undergraduate Research Highlights Editor
Nicole Bennett
bennettns@appstate.edu

Contact Information for Submissions and Other Correspondence —

All materials should be submitted electronically via email to the *CUR Quarterly* Editor-in-Chief:

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