

A PROPOSAL FOR GEOLOGICAL SCIENCES TO JOIN THE SCIENCE EDUCATION INITIATIVE

The Department of Geological Sciences fully embraces the goals of the Science Education Initiative and proposes to join the initial cadre of departments implementing that initiative. The teaching of Earth Science offers unique challenges to the initiative given the inherently interdisciplinary nature of the subject, its mix of laboratory and field investigations, and its dual focus on the Earth's current state and past history. Current teaching methodologies in our field are well entrenched and have not been reassessed in a wholesale manner in decades. We feel the SEI will have a significant impact on our Department, and may also serve as a vehicle to energize science education in the entire discipline.

Breadth and depth of faculty interest.

After a thorough discussion during a November faculty meeting, the Department expressed its commitment to participating in the initiative by a vote of 16 to 1 with 1 abstaining and 10 absent. Nearly every faculty member who teaches in our 1000-level courses or upper division core courses (the source of ~80% of our annual student credit hours) endorsed the initiative. Further, all 10 of our tenure-track junior faculty have expressed an eagerness to personally participate.

The Department's enthusiasm for the SEI stems from our experiences with clicker technology. Twelve faculty members have utilized this teaching aid at the 1000-level since the fall of 2004. All found it to be a positive experience and something that, to varying degrees, changed how they teach and their enthusiasm for teaching at this level. In addition, many of our faculty routinely use WebCT, web-based animations (some designed by our own faculty), and virtual field trips in their 1000-level courses. One faculty member has independently begun assessing student attitudes towards science and experimenting with different approaches towards teaching. Other faculty have been wrestling with how to better integrate active research and scientific methodology into the undergraduate curricula. Collectively, these experiences have awakened the Department to the potential of new and improved methods of teaching, assessing the effectiveness of their teaching, and assessing student learning and retention. The Department is committed to pursuing this potential.

Implementation of the SEI in Geological Sciences

We propose to implement the SEI in a three stages. In the first year, the focus will be on our three 1000-level courses and the 1-credit, introductory 1030 laboratory, which is a separate course. These courses generate most of our student credit hours and about one-half of our 31 tenure-track faculty and instructors teach one of these courses in any one year. Focusing first on these introductory courses will have the greatest immediate impact on students and faculty. We will emphasize our major-track courses in the second year of the initiative and upper division A&S core courses in the third year. By the end of that third year, it is likely that ~90% of our teaching faculty will have been exposed to the initiative.

We anticipate utilizing two SEI Teaching Fellows (TFs). We would like the first to be a new hire (instructor or post-doc) trained in both the Earth Sciences and science education, with an understanding of current educational pedagogy and assessment issues. This person should be interested in education-orientated research and thus be in the position to understand issues related to both content and method, have incentive to insure publication of SEI results relative to the Earth Sciences, and would take their Colorado experience to other institutions. For the second hire, we would like to consider one of our current senior instructors who is familiar with our curriculum and who would help insure institutional memory in outlying years. That person, Dr. Henrietta Laustsen, also teaches three of our major-track courses, which is an obvious benefit.

We also propose to involve graduate students in the Science Education Initiative by establishing Graduate Teaching Fellows (GTFs). These would be graduate students who have determined an intention to pursue careers in academe. (Our graduate student population is ~40% PhD & ~60% MS with half of each group pursuing opportunities in industry upon graduation. Thus, we would focus on senior grad students rather than first year teaching assistants as the later often do not know their ultimate career path). Appointments would be for

1 year at a 50% rate with in-state tuition. The GTFs would work closely with the faculty and TFs and add substantial manpower, energy, and creativity to the tasks of defining teaching goals, methods of assessment, and new teaching materials. In addition, the GTFs would work together to compile a "manual" of SEI results for each course, thus helping to archive goal statements and effective teaching materials and methods for future users. We believe the 4 GTFs per year are necessary to implement the SEI in the Geological Sciences because no TAs are assigned to our 1000-level introductory courses (they are used for upper division lab courses and the stand alone 1030 course).

Incentives for faculty to improve student learning and participate with the SEI

The Department recently completed a reassessment of its annual merit expectations and has made teaching at the 1000-level a requirement for meeting expectations because we value teaching at that important level. If accepted into the SEI, the Department's Executive Committee will propose that participating in the SEI be added to the criteria for annual merit evaluations. Participation will thus be rewarded. As the goals of the initiative have already been embraced by the vast majority of the faculty, and that majority has already pledged to participate, we do not anticipate the need for further "incentives".

Policies to encourage effective reuse of effective teaching materials and methods.

In Geological Sciences, a faculty member teaches the same upper division course every year and anyone who teaches an A&S core course does so annually or semi-annually. The rotation of faculty into and out of courses for fixed periods of time is not done in our Department. Over the initial 3-year period of the SEI, ~90% of our faculty and instructors will have participated in the transformation of one or more courses, and that includes all junior faculty. We anticipate that the demonstrable advantages of the changes to teaching styles and methods will be incentive enough for all our faculty to continue the reuse of the new material and methods.

The strong buy-in by our junior faculty insures sustainability over the long term. We also have a tradition of sharing teaching materials and methods with new faculty, with their assigned faculty mentors taking the lead. Mentors will be instructed to share the strategies of the SEI. Finally, all new digital products and the manuals mentioned above will be archived on the department's resource web pages (www.colorado.edu/GeolSci/resources). With the help of the SEI staff, we envision a digital "bank" of course materials (course goal and content statements, assessment tools, teaching materials, etc) from which faculty can sample in future years. Administration of the digital repository will rest with the department's systems administrator, who is already paid in part from course fee money due to his support of the teaching mission.

In order to keep all faculty informed of continued teaching developments and enhancements after the 4-year period of the SEI, we will schedule 2 talks per year in our Departmental colloquium that will focus on continued developments and new experiences related to teaching methods, materials, and assessment. In the advent of a large turnover in our teaching faculty, we will use internal workshops to insure that new faculty and instructors are brought up-to-date on teaching goals and assessment methods.

Policies and processes to ensure adherence to goals and assessment initiatives

As outlined above, the faculty of Geological Sciences have pledged to participate and participation will be part of each faculty member's expectations. Our historical willingness to move the Department's mission forward in a collaborative way is evidenced by our rapid embrace of clicker technology and our culture of collegiality and sharing of resources and ideas. Thus professional commitment, collegiality, and peer pressure should be sufficient to insure that the SEI goals and assessment initiatives will be respected by all. Nonetheless, to insure that this is the case, the Chair will appoint Dr. David Budd, a full professor, as the Department's "PI" for this initiative, with his duties to include the monitoring of all faculty member's progress in course transformations and adherence to the SEI initiative. Dr. Budd will also serve as a Department-wide liaison to the SEI staff, TFs, and GTFs in Geological Sciences. Dr. Budd will also take responsibility for insuring continued use of the SEI outcomes in our curriculum.