Reinventing the Introductory Geology Course for Engineering and Other Quantitatively-able Students

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Our fairly traditional GEO203: Physical Geology had for years served as entry into the department. However, enrollment in the course had been steadily declining; we found that many of our majors were entering the department via topical "Freshman Seminars" and that upper level students in other departments, including engineering, were taking upper level courses and opting out of taking GEO203 altogether.

We also noted that the introductory geoscience courses are typically taught at a lower and less-quantitative level than introductory courses in the other sciences or engineering. While these courses can be valuable, engaging and indeed do attract students to the geosciences (as happened to me), we wanted to re-invent the introductory course in order to specifically target and attract two particular types of students: civil and environmental engineering majors and also students who have quantitative skills and science backgrounds typical of someone considering a major in, say, math or chemistry or physics. These students are not particularly attracted to the standard Physical Geology course.

Thus, we (Professors Jeroen Tromp and John Higgins, graduate student Jonathan Husson and myself) have undertaken a major revision of GEO203, renaming it "Fundamentals of Solid Earth Science." It was offered for the first time in the fall of 2012, with the following course description: "*a quantitative introduction to Solid Earth System Science, focusing on the underlying physical processes and their geological and geophysical expression. Topics include basic physical conservation laws, examples of constitutive relationships, waves, transport phenomena, geopotential fields, geologic time, basic thermodynamics and mineralogy. Single variable calculus is a prerequisite.*"

Our goal is to present and teach the geosciences as an interdisciplinary field that is as modern, quantitative and rigorous as any other science or engineering course of study. We hope to blur boundaries by engaging engineering students in geoscience problems and applications, and exposing non-engineers to engineering approaches and perspectives. The course fulfills a requirement for Engineering students as well as for Geoscience majors.

The course has weekly precepts and extensive problem sets instead of weekly laboratory sessions, although we also take the students on two field trips and use some lab-like activities and in the problem sets. In additional to calculus, we also include basic linear algebra and introduce students to MatLab.

The Fall 2012 version was moderately successfully, with mixed student reviews. One problem is that there is no appropriate textbook so we have used a combination of faculty-generated class notes (perhaps a textbook in the future?) as well as suggesting portions of existing texts; these reading assignments need to be made more explicit. We also need to do a better job of integrating geology topics with the quantitative material, and of integrating lecture with precept/problem set material.

But with about a 50:50 mix of engineering students to non-engineering, about 1/3 of the class are taking upper level geoscience courses for the spring. Several students have started working in Geoscience research labs and are planning geoscience topics for their junior and senior independent work. We're currently reassessing and revising in anticipation of the second running of the course in the Fall of 2013.