

QES initiatives at Stanford

These notes are paraphrased from the response to a request for information sent by C. Schoof to colleague Dustin Schroeder at Stanford U. in spring 2020. The following describes recent initiatives to rebuild a geophysics undergraduate major.

What recent structural changes to QES programs have been implemented? *"We have been working to revitalize our geophysics major", and "[our's is] a small, flexible, research-based quantitative major that's growing in popularity. Definitely feels like we're on a growth track."* Details, paraphrased from the original email reply:

- 1) Goals: **take advantage of what we are** and have explicit pipelines for 2 types of students:
 - a) environmental studies students who are scared of math but may discover they like it after all,
 - b) physics/engineering majors who discover there is quantitative earth science.
- 2) **Cut required core courses down** focusing on the core strengths of our department:
 - a) Measurements, Instruments, Fields and Waves,
 - b) Mathematics, Computation, Mechanics and Dynamics, and
 - c) Laboratory Studies.
 - d) An **introductory seminar course**: a "parade" of short faculty talks, a recitation/tutorial involving short readings and one problem created by each professor (breadth of the department) [FJ: at EOAS, this could be EOSC 212]
 - e) a thesis-writing senior **capstone**.
 - f) This makes it possible for people to "discover" us in their 3rd or 4th year (from another STEM major) and switch to geophysics (or add it as a second major)
 - g) All other courses are "geophysical electives" – a "caltech style" experience in which undergraduates take courses with mostly grad students or from across campus (with approval).
- 3) **Focus on teaching well.** [FJ: They likely benefit from Stanford's Weiman group.]
 - a) Watch reviews and keep faculty appraised & supported.
 - b) Polish courses, package resources and strategies, and work with co-teachers to ensure sustainability.
 - c) Non-core courses are electives taken by both grads and undergrads – "Caltech style".
- 4) **Each undergrad has several mentors:**
 - a) Director of undergrad studies
 - b) A faculty mentor based on a match-making process
 - c) Grad student also based on a matchmaking process
 - d) Research advisor for thesis (maybe same as (b))
 - e) Undergrad peer advisors: one "charismatic" senior gets a part-time job, holds office hours, homework events, social events.
- 5) **Social events**, e.g., at a faculty member's home twice a year for majors plus faculty; builds community and commitment among both faculty and students.
- 6) **Recruiting / marketing:**
 - a) Meet with leaders of other programs to discuss our courses and to get them listed on websites and in bulletins and as options for other programs.
 - b) Meet with academic advisors to explain our major
 - c) Attend as many "first year" major shopping events as possible
 - d) Volunteer as a "pre-major advisor" (and pester colleagues to do so too).
 - e) Lobbied to offer guest lectures in courses in other majors/schools targeting incoming students (They do one in physics, one in engineering, and one in data science) to get students interested.

Results:

- Annual enrollment in in [geoph major](#): 2016-2020: 2, 2, 0, 5, 8. They started from "zero students".
- Enrollment in core QES courses **and** trends: Intro to geophysics: 2016-**2020**: 7, 30, 14, **40**
- What other students take these courses? *"We meet the physics requirements for the earth systems major and are a science track in the physics major and a science elective for others"*.
- What links with non-Earth Sci. dep'ts? *"I think this is utterly key."* The program is structured so physics and engineering students can take geophysics courses as electives and switch into this program even late in 3rd or 4th year.