

Is there a problem with quantitative preparation of undergraduate geoscience students for graduate programs?

Session Report: 9:30-11:45 AM, Tuesday, Feb. 21, 2006

Geological sciences are extremely effective at teaching undergraduate students how to think historically, visualize three-dimensional data, and collect objective data sets. Less explicitly, some geoscience faculty focus on helping students develop written and aural communication skills. These skills currently form the “pillars” of geoscience training. Significantly lacking behind is the development of quantitative skills in undergraduate geoscience majors. We suggest that quantitative skills join historical analysis, visualization, data collection, and communication as pillars in the pantheon of skills developed within the geoscience curriculum.

In our experience, there is a shortage of students who have strong backgrounds in both geoscience and quantitative analysis. This shortage is more severe in some fields than others. As a result, in some areas, graduate programs look outside the geosciences (mathematics, physics) for adequately prepared students. A low level of quantitative preparation can limit the fields that a student feels prepared to study and the areas in which they can obtain admission to graduate school. One of the most important consequences of the current level of quantitative analysis in the undergraduate curriculum is a mismatch between undergraduate students’ perception that geoscience is a descriptive field and the current research front which involves highly quantitative analysis. We recognize that increased quantitative preparation and increasingly quantitative approaches to geological problems, as a long term goal that begins with students but carries through the professional life of a geoscientist.

The most important shortcoming in the quantitative preparation of many undergraduate geoscience majors is the absence of facility in using quantitative skills to solve geoscience problems. Many geoscience students applying to graduate programs lack the abilities to

- pose problems so they can be addressed quantitatively
- understand relationship between quantitative concepts and physical representation
- visualize mathematics
- test the reasonableness of quantitative results
- creatively move forward from existing models/techniques/approaches
- move between quantitative and verbal descriptions

Many students don’t think precisely and lack practice in using quantitative skills. Statistics and programming skills are often missing.

Central to making progress in developing strong quantitative skills in geoscience students is a change in attitude on the part of both faculty and students. Quantitative skills must be viewed as important and central to geoscience not as an optional skill that may not be needed to understand concepts. We recognize particular value in infusing quantitative approaches to geoscience throughout the curriculum beginning with the introductory

curriculum as a mechanism for changing this attitude and for developing the habits of mind, ways of thinking, and skills that lead to strong quantitative competency.

While we recognize that quantitative skills can be obtained in a variety of ways, math courses are commonly used to assess students quantitative aptitude and background. This may not be the optimal situation. Infusion of quantitative skills in the curriculum and quantitative research experiences may be other important sources of quantitative competency.