

# A FRAMEWORK FOR LEARNING-CENTERED CURRICULAR INNOVATION IN THE DEPARTMENT OF GEOLOGY AT THE UNIVERSITY OF DAYTON



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## BACKGROUND TO OUR COMPREHENSIVE REVIEW

Previous paradigm: what should we be teaching our students, in terms of curriculum?  
To: What skills should our students be learning? How can we assess their learning?

### Department Concerns

Recently the Department discussed and developed Academic Competencies. These include higher level thinking skills and geology-related skills such as effective note-taking, mapping skills, and ability to identify and assess sequences and patterns of geological events and processes.

We have also discussed an increasing inadequate preparation of undergraduates for upper level course work. We also noted that some undergraduate were not prepared for entry into the job market or for application to graduate school.

Marianist Habits of Inquiry and Reflection (HIR) have been developed by a campus committee, and departments and their curriculum will soon need to demonstrate how they are meeting these objectives. **In our framework, the two goals come together to form our learning-centered paradigm.**

## NEW CURRICULAR INITIATIVES

**Professional Practices Seminar:** prepares students for the job market or graduate school and addresses the HIR outcome of vocation.

**Critical Issues in Earth and Society Seminar:** most of the course is spent researching and discussing an important critical earth science issue. Addresses the HIR outcomes of scholarship and critical evaluation of our times.

**Second Year review:** is run in conjunction with the critical issues seminar. It revisits key concepts students should know. Students must pass a multiple choice exam covering introductory material.

**New Courses:** have been developed in Advanced GIS, Remote Sensing, and Earth Systems. These build upon the research expertise of newer faculty members. All address the HIR outcome of scholarship. In development: a course provisionally called the Inner Earth, envisioned as a synthesis of geophysics and petrology.

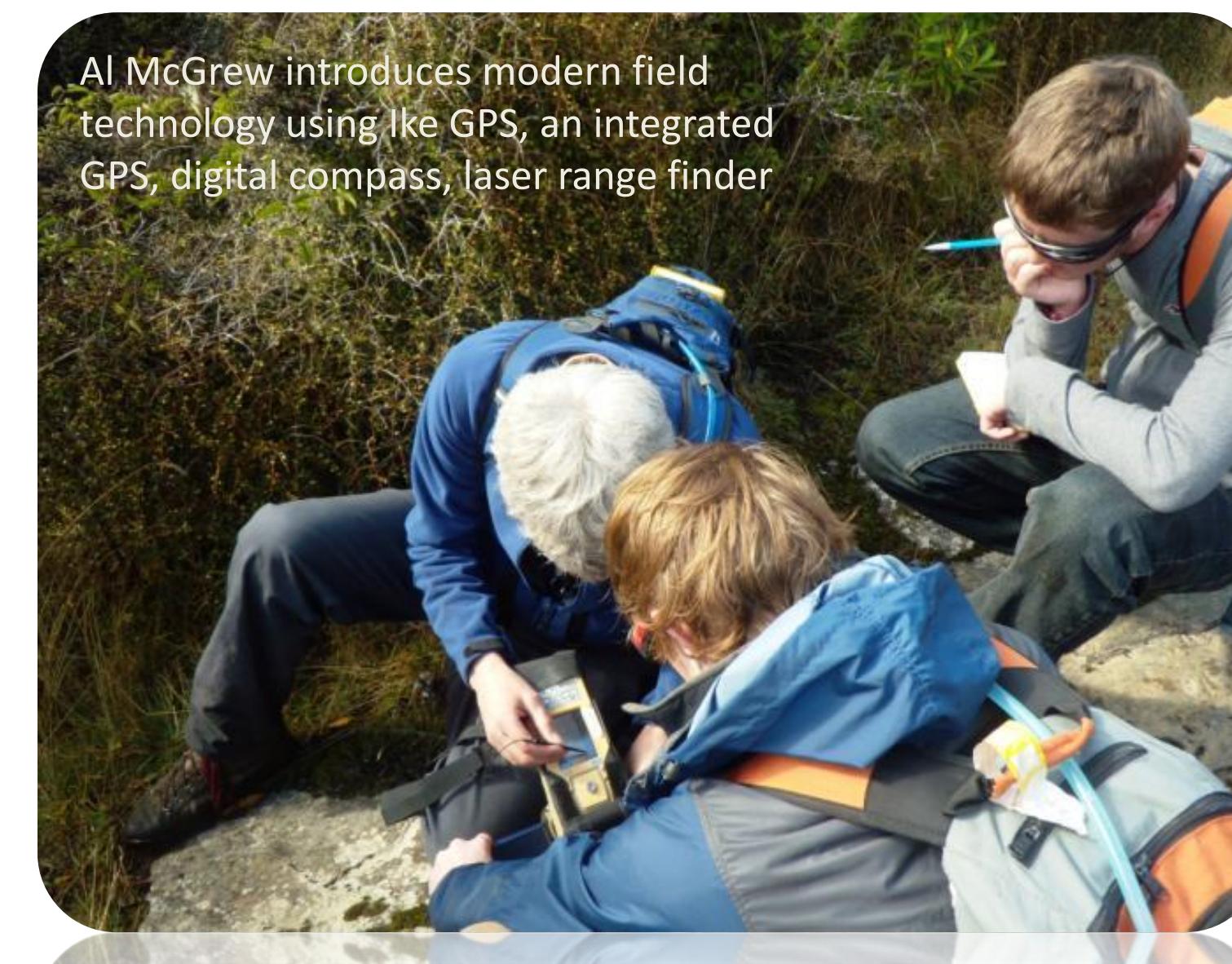
HIR Outcomes	Dept. Learning Outcomes	Sample Measures Used
<b>Scholarship:</b> advanced habits of academic inquiry and creativity through the production of a body of artistic, scholarly or community-based work intended for public presentation and defense.	Graduates will complete and publicly present a capstone project that demonstrates research skills relevant to their careers. Graduates will be adequately prepared for graduate school.	All graduating students will satisfactorily complete at least 3.0 credit hours of thesis work, or other capstone project Graduates will be adequately prepared for graduate school.
<b>Practical wisdom:</b> addressing real human problems and deep human needs, drawing upon advanced knowledge, values, and skills in their chosen profession or major course of study	All graduates will demonstrate a familiarity with the fundamentals of geological field investigation. Graduates will be adequately prepared for employment in the geologic and/or environmental arenas. Graduates will demonstrate an understanding of the relationship between science, culture, and society.	All physically able graduates will complete at least 15 days of intensive training in the fundamentals of field investigation, through course work in Field Geology and/or other classes, independent study and/or thesis work, and class field trips. At least 75% of graduating students will complete an internship, summer research experience, summer job, student teaching, or volunteer experience in an earth science-related field.
<b>Vocation:</b> Using appropriate scholarly and communal resources, all undergraduates will develop and demonstrate ability to articulate reflectively the purposes of their life and proposed work through the language of vocation	Graduates will be able to describe and discuss how the vocation of Geology can be applied to address human needs and problems, and to improve human quality of life. Graduates will demonstrate basic professional practices; and explore post-graduate opportunities.	All graduates in Geology and Environmental Geology will satisfactorily complete a professional practices seminar. At least 75% of graduates will either find employment in a geoscience-related field or will be accepted into a graduate program in their area of interest within 6 months of graduation.
<b>Critical evaluation of our times:</b> Through multidisciplinary study, informed by familiarity with Catholic Social Teaching, to evaluate critically and imaginatively the ethical, historical, social, political, technological, economic, and ecological challenges of their times in light of the past.	Graduates will develop the capacity to critically analyze the great environmental challenges of our time. Graduates will understand and be able to articulate the role of science, and especially earth science, in the public sphere.	In exit interviews, graduating students will be able to discuss how their education in Geology or Environmental Geology expanded their awareness and understanding of contemporary issues in Earth and society.
<b>Community:</b> understanding of and practice in the values and skills necessary for learning, living, and working in communities of support and challenge, including accepting difference, resolving conflicts peacefully, and promoting reconciliation.	All students in the Department of Geology will participate in Geology Field Camp where they will work and live together in a community that shares the common goals of learning and helping one another succeed in a non-traditional setting.	On the Annual Survey of Existing Students, at least 75% of graduates will be able to cite at least one departmental activity that they regularly participated in
<b>Diversity:</b> intellectually informed, appreciative, and critical understanding of the cultures, histories, times, and places of multiple others, as marked by class, race, gender, ethnicity, religion, nationality, sexual orientation, and other manifestations of difference.	All students in the Department of Geology will feel welcomed and engaged in all departmental activities without regard to the diversity of their backgrounds or personal identities.	On the Annual Survey of Existing Students, all graduates will "agree" or "strongly agree" with the statement, "As an undergraduate in the Geology Department of the University of Dayton I felt welcomed and encouraged to participate in any and all departmental activities."

## A New Approach to Field Studies

Like many undergraduate Geology programs, the University of Dayton Geology Department views our field program as a crucial component in the training and acculturation of future geologists. We have long utilized a 3 week field course in the Colorado Rocky Mountains as a "capstone" to the first year experience, taking the introductory field course immediately after Historical Geology. By taking this course early in the students' career we aim to solidify student understanding of the basics of Geology while also cementing their disciplinary interest and engagement and building departmental community by living and learning together in an immersion environment.

While maintaining this philosophy, in May 2010 we steered the introductory field course in a new direction, enhancing the focus on active geologic processes by taking the field course to New Zealand where students explored an array of active processes ranging from volcanism (North Island) to glaciation (Southern Alps) to young tectonic uplift (Hawkes Bay). In addition, this new approach enabled us to tie into key University-wide learning outcomes such as diversity and community by emphasizing the complex interrelationships between New Zealanders (both the indigenous Maori and those of European descent) and the diverse hazards and resource opportunities presented by their dynamically evolving environment.

Finally, we also developed a new integration between the field course and our departmental seminar program, using New Zealand as the theme of our Spring seminar in order to maximize student preparation for their field experience by researching diverse aspects of New Zealand geology prior to the field course.



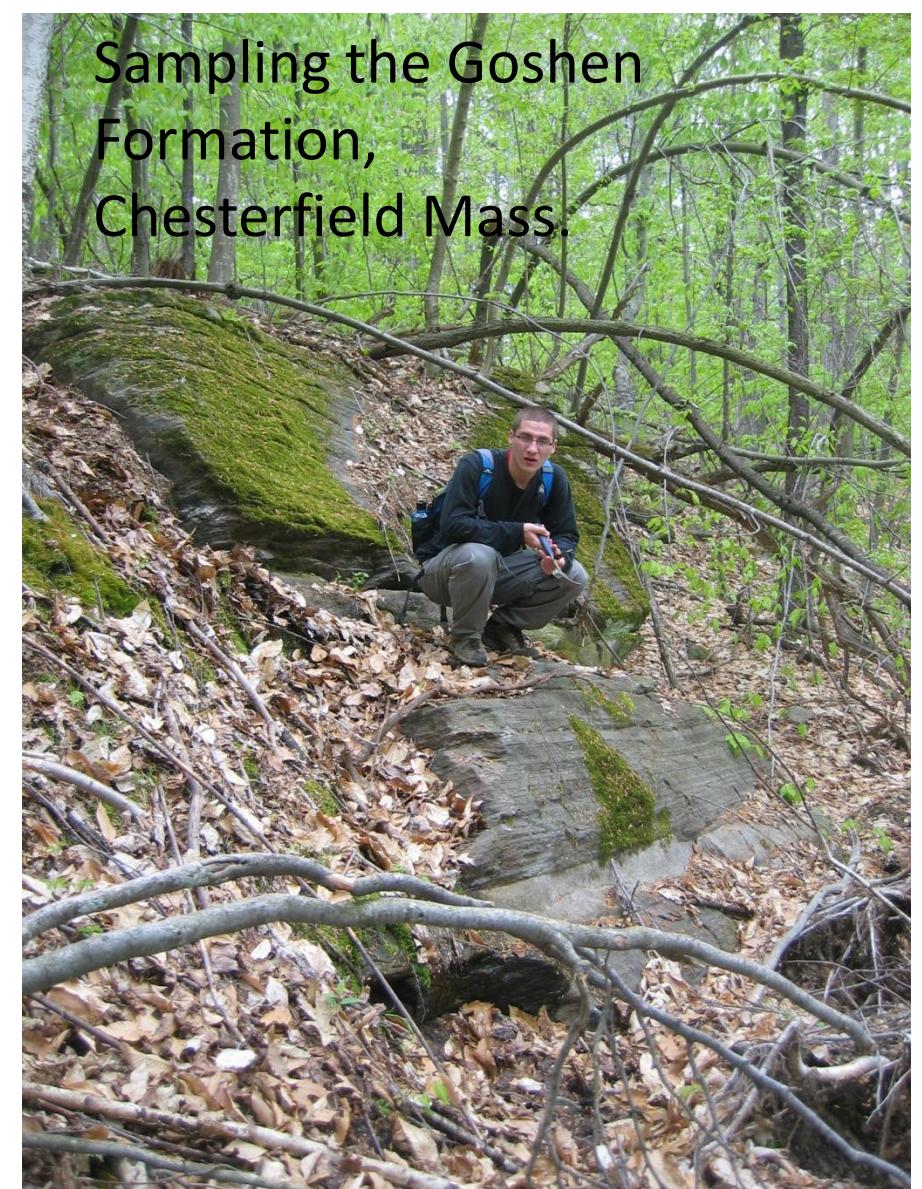
Al McGrew introduces modern field technology using the GPS, an integrated GPS, digital compass, laser range finder



UD Field Course 2010:  
Students explore active volcanic processes on White Island, New Zealand

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## DETAILS ON IMPLEMENTATION OF OUR INITIATIVES

### 1. Professional Practices seminar

This one credit seminar first asks to students to think about their future career path. It specifically prepares students for the job market and applying for graduate school by having students prepare a resume, participate in a mock interview, and participate in a business lunch. They also research graduate schools and compose a statement of purpose.

**Implemented:** Fall Semester 2009, repeated Fall 2010

**Results:** A few students prepared resumes for the first time. For faculty, our experience highlighted the need to emphasize professional behavior and the importance of 'soft' people skills.

### 2. Second Year Review with Critical Issues Seminar

The topic in Spring 2010 semester was the Geology of New Zealand in preparation for the Summer Field Course. The topic in Spring 2011 was discussion and analysis of the IPCC Climate Report. All students participated in reading and discussion of various topics. All students researched and wrote a paper on a sub-topic of their choice, and presented an oral report on this topic to the class.

The topic in the Fall 2011 Semester is Environmental Issues surrounding Hydraulic Fracturing, specifically in the Marcellus Shale.

**Implemented:** During the Spring 2010 semester, the second year exam was not required but recommended. During the Spring 2011 the exam was required. The Review will be run again in the Spring 2012 semester.

**Results:** Only one student out of five passed the exam the first time in the Spring 2010 semester. In the Spring 2011 semester, when the exam was required, only one of three students passed the exam the first time. The other two students were given feedback and time to review, and eventually passed the exam after two more attempts.

This is a necessary part of our program. Students may need more classroom review in certain topics, as retention of knowledge appears to be an issue.



## CONCLUSIONS

The new courses do well in addressing department-identified competencies and HIR outcomes.

The second-year review reveals certain gaps in student knowledge and a certain lack of retention of physical and historical geology concepts.

The time to work on curricular changes is now, as the HIR outcomes will be implemented in 2014-2015.

## WHAT'S NEXT FOR THE UNIVERSITY OF DAYTON DEPARTMENT OF GEOLOGY?

- Continue the Professional Practices Seminar
- Continue the Critical Issues and Second Year Review
- Continue development of the field program
- Implement and require an exit interview, for assessment of our overall program
- Develop the Inner Earth Course
- Encourage students to take the ASBOG Fundamentals of Geology exam, or develop an exit exam of our own. This would help benchmark our students against a national cohort.
- Develop an E-Portfolio of student work and list of student participation in activities, housed at the University of Dayton but accessible by students after graduation. Contents could include:
  - Field camp report
  - Research paper or class projects from upper-level courses
  - Second Year Review exam score
  - Resume and statement of purpose from Professional Practices Seminar
  - Paper and poster or powerpoint from Critical Issues Seminar
  - Student reflection from Geoscience Service Project, if any
  - Thesis or capstone project
  - Possibly exit exam/GRE/ASBOG exam score