**Current Assessment of the Geology Programs at California State University, Bakersfield**

**Dirk Baron**
**2/10/2009**

The geology program at CSUB is a small program at one of the smaller campuses of the CSU system. We currently have four tenure-track faculty, about 45 undergraduate majors and about 12 graduate students. We offer BS and BA Geology undergraduate degrees, as well as a MS Geology degree. We also contribute to the university's general education program as well as the liberal studies major for future elementary school teachers. The university has about 7,500 full-time students.

Our department has long resisted the push for program assessment, discounting it as more busy work and arguing that the grades we give in our classes are sufficient assessment of student learning. Until recently, we have therefore doing as little as we could get away with.

Specifically, we have been tracking the following:

1) Field Camp – all of our undergraduate BS majors are required to complete a 5-6 summer field camp course as one of their capstone experiences. We have not offered this course for many years so the students have to attend field camps organized by other universities. Everything in our curriculum is required to be successful in field camp. Our students are evaluated by faculty from other universities and compared to students from other universities. The grades in field camp therefore represent a true independent assessment of what our students have learned and they can be compared to those from other departments. We have been tracking the grades in field camp and have also requested feedback from the field camp instructors to identify possible areas of weakness. This data has not only been useful for us, it has also brought us some kudos from various review committees which thought that this is a great example for truly independent assessment.

2) Alumni – the ultimate test of the value of our degrees is how well they serve our graduates. We are therefore keeping track of their careers after they graduate, including starting salaries, types of careers, and employers. This has the additional benefits of supporting our alumni outreach and our recruitment efforts. We are developing alumni highlights that give prospective students an overview of the career pathways our degrees open up.

When I became department chair in 2007, I realized that a well though-out assessment program could help us (1) improve the effectiveness of our programs, (2) demonstrate their worth to the university and the community, and (3) support recruitment of new majors. We are now developing surveys for graduating students and working on assessment for

some of our larger majors classes including Physical Geology, Environmental Geology, and Hydrogeology. We are also planning to survey employers of our graduates to determine how well our programs have prepared them for their careers.

As part of a school-wide effort to assess our general education offerings, we have recently developed and implemented an assessment program for our lower division and upper division general education classes (which include two majors classes, namely Physical Geology and Environmental Geology). The main assessment tools are embedded exam questions which are aligned with the goals and objectives of the natural science part of the general education program.

**Assessment of student learning in the geology program at Muskegon Community College**

Before I began writing this essay, I thought it might be advisable to take a look at the participants list to see who might be in the audience. As I suspected, most of the participants are from 4-year colleges and universities, with programs ranging from exclusively undergraduate to those with doctoral degree programs. So my perspective on assessment in the geosciences comes from a very different point of view than most of you.

The geology "department" at MCC consists of one faculty member (me), in a department that includes the disciplines of astronomy, chemistry, mathematics, and physics. We do not offer a major in geology; in fact, the entire geology curriculum consists of two courses: introductory physical geology and historical geology, with labs in each. Most of the students who take these classes are not intending to become geoscientists, but instead enroll to meet a general education requirement for the associates degree, or a requirement at their intended transfer institution. The only prerequisite for enrolling in either of these courses is a $10^{th}$-grade reading comprehension level, determined by placement testing.

As a result, the assessment measures that I employ are somewhat limited in scope, being addressed exclusively at the course level. I use a variety of methods to assess student learning, from traditional exams and quizzes, to individual written reports, to collaborative exercises involving small groups of students. Because my classes are small (24 students in a full section), it is fairly easy to get to know each student over the course of a semester, and to develop some idea as to what they have learned by the conclusion of the course. Quantifying these impressions, however, is problematic. Each class is also assessed through the use of student opinion surveys that are administered at the conclusion of each semester. These have recently been changed from the traditional format of "what did you like/dislike about this class/instructor" to surveys with questions that address specific course learning objectives. These have only been in use for one year, however, and have produced limited data.

I confess that I have always been somewhat skeptical about assessment measures and their supposed influence on improving student learning. My impression is, and has been for a number of years, that we do these things primarily as a means of justifying our own existence, whether as individual faculty, as departments within our home institutions, or at the institutional level itself. While that may be an important outcome for our profession, I'm not sure if it leads to improved student learning. Instead, we seem to have verified the obvious: complex, difficult concepts are hard to learn, while simple concepts are easy.

# Outcomes Assessment in the Earth and Environmental Science Department of C.W. Post College of Long Island University

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Our department serves majors in geography, geology, earth system science, and environmental science. We also provide the academic content for early and adolescence education students. Our graduate programs are a master's in adolescence education in earth science and a master's degree in earth science. A significant department responsibility is serving students who are fulfilling core requirements in laboratory science (earth science or geology) and in social science (geography).

Our early discussions of outcomes assessment involved questions of the rationale as well as concerns about extra work for faculty. Faculty were reluctant. But, nevertheless, in Fall 2005, we agreed on a theme: graph and diagram interpretation. Then we decided on a fact-finding expedition. We gave all our classes a pre-test with two parts, first asking students for their own perceptions of their skills and then a series of questions. At the end of the semester we gave a post-test, again asking for student perceptions and including a short quiz. Student results were good, and we are expanding our work to see how graph and diagram interpretation can improve student learning in our major course of study and in the liberal arts in general.

We had a series of discussions in which we gradually hammered out some department and content-specific goals and outcomes and outcomes measures in Spring 2007. In doing so we looked at what other geography and geology departments had done. We read literature produced by our professional organizations. We thought about our students and integrated the global perspective with that of our own department. Our goals and outcomes are included in our plan which is a separate document.

## Challenges:

### Trivialization concerns:

Our challenges include balancing our overall goals with the choice of measures. Faculty were particularly concerned about trivializing our learning. We discussed and debated in person and through e-mails, trying to reach logical bases for matching our goals with our measures.

### Adjunct faculty:

Many sections of our introductory courses are taught by adjunct faculty. We have included them in discussions of approaches to be applied. They have been extremely cooperative in applying our measures in their teaching and examinations.

Preparation of our students:

As with many institutions across the country, some students at CW Post may benefit from additional support in such areas as quantitative reasoning. We have built those needs into our setting of goals and measures, trying not to diminish overall learning.

Developing a mission statement:

At this time, we have decided to use the mission statement for the whole C.W. Post Campus. We have limited time and felt that our meetings and time would be better spent not debating the wording of a department mission statement. We know that is something we have to address and will, but not right now. We look forward to hearing from other departments.

California State University, Chico, is a residential campus set in the northern Sacramento Valley at the base of the Sierra Nevada. We are a comprehensive university with a student population of 16,000 in a city of 100,000. The emphasis is on undergraduate education, although we offer a number of small master's degree programs. Each year, the Department of Geological and Environmental Sciences awards 5-10 MS degrees, 10-20 BS degrees in geology, 10-20 BS degrees in Environmental Sciences, and 1-2 BS degrees in Geosciences (a degree that prepares students to teach secondary school earth science).

In the mid 1990's the Department of Geological and Environmental Sciences constructed an exit survey for graduating seniors and began administering it every spring. For several years, the survey yielded useful data and spurred us to make helpful curriculum changes. But a waning in pressure from upper levels of administration to do assessment and waxing pressure from them to attend to other matters--coupled with several changes in department chair-- caused the practice to lapse for almost 10 years.

As CSU Chico began undergoing review of its accreditation by the Western Association of Schools and Colleges (WASC), the upper administration greatly increased the pressure on departments to conduct formal assessment of their programs. In 2005, the administration required every academic program to establish official program goals and, within each goal, to write specific measureable student learning outcomes. Since then, each department has been required to submit annual assessment reports. Each year, we must assess a subset of our program goals on a rotating basis, so that every student learning outcome is assessed at least once every five years. The Department of Geological and Environmental Sciences has completed three rounds of this assessment and is currently engaged in the fourth round.

During this recent push for assessment, recognizing that CSU Chico faculty have little time for assessment while carrying 12 "weighted teaching unit" loads (12 hours per week, with each hour in lab counting as only 2/3 hour), the administration recently provided funds to each department to pay for 3 hours of release time for an assessment coordinator. I have held that position since January 2008.

I began by reviving the exit survey. I then worked with colleagues to improve and flesh out the program goals and learning objectives. I am currently engaged in facilitating the development of embedded assessments in courses throughout the curriculum. This embedded assessment consists of specific questions on exams and designated aspects of student projects. We use detailed rubrics to score the student work, using them for both grading and assessment purposes. We archive digital copies of the student work, with the intention to track the progress of selected individual students over time.

Our most useful embedded assessments have, to date, come from our field courses. We are in the process of trying to demonstrate progressive skill and knowledge development in our students by comparing their work in our junior-level field course with their later work in the final mapping course.

# STUDENT OUTCOMES ASSESSMENT AT IUP

Outcomes assessment has been an aspect of the IUP Geoscience Department's self reviews since the 1980's, but until 2005, it was primarily conducted through informal exit interviews with graduating students and occasional surveys of alumni. At that time, I attended a student outcomes assessment workshop conducted at IUP by Dr. Barbara Walvoord. Using her suggestions, the department was able to focus on our goals, examine our curriculum and establish the use of concrete assessment tools.

For our departmental majors programs (Geology, Environmental Geology and Earth & Space Science Education), we tried to focus on learning goals which bridged all three programs, and which could be assessed in classes taken by our entire major population. Our goals included general outcomes that all of our courses could teach and assess, such as the development of 1) better oral and written communication skills and 2) better quantitative skills. We also wanted to make sure that our students were learning and practicing important 3) professional skills such as using a Brunton Compass, as well as mastering 4) critical content such as plate tectonics and evolution.

After we established learning goals for our students, each department member completed detailed questionnaires listing the subset of goals that he/she taught in upper-level courses and what specific activities were assigned to accomplish those goals. We were able to identify several places where the same goal could be re-assessed at a later stage of the major program in order to see whether students were making progress or building on previous learning. Implementation of major assessment has been spotty, however, because it relies on individual professors to carry out each part in their own classes, and we have no mechanism for those professors to report back their data to the department as a whole. This is a major weakness of our assessment program and limits its usefulness.

The most successful assessments we have instituted so far are those that measure general skills and that can be incorporated into senior capstone courses (a research seminar for two of our majors and a student teaching demonstration for the third one). Rubrics have been created that allow multiple faculty to record their assessments consistently, and these have been archived in paper form along with electronic records of the student work that was assessed. However, one issue that still remains to be tackled is whether professional skills and content knowledge can be assessed as easily in this way as communication and quantitative skills.

At the same time as we established our assessment goals for majors, we also tried to establish goals for our non-major (introductory) students. It was easy to find learning goals for them in the science requirements of the general studies program, but it has been much more difficult to assess student outcomes effectively for the large introductory classes we teach. This is still an issue we are grappling with and have not solved.

**Cinzia Cervato - Iowa State University**
**Department of Geological & Atmospheric Sciences**

# Pre-workshop essay

## Student assessment

In 2004 Iowa State University requested that all departments prepare an outcomes assessment plan. The goal was to ensure that our students have the best educational experience possible. I was asked to chair the committee and put together an alumni survey, an assessment plan and an assessment matrix that are now online on our web site (http://www.ge-at.iastate.edu/assessment.shtml). We administered the survey to our alumni in 2004.

The main instrument for assessment is an exit interview with the department chair (for geology and Earth science majors) or the associate chair in meteorology (for meteorology majors). These are informal and there is no form or rubric. There is also an exit survey and self-assessment form but students rarely turn them in (2 out of 18 seniors returned them last spring). The response rate might improve if the survey were administered online. I have never seen the results of these interviews or know of any specific changes that have been implemented as a result of comments made by students.

## External departmental reviews

Iowa State University provides general guidelines for program reviews that are conducted every 7 years. The full document related to external reviews (Word and pdf versions) are found at:

http://www.academicprograms.iastate.edu/assessment/academicPRPolicy.doc
http://www.academicprograms.iastate.edu/assessment/academicPRPolicy.pdf

This includes guidelines for the department for preparation of the self-study report, as well as a list of general topics that the external review committee should address (section V.D.). In

addition, each review team is given a set of questions from the college specific to the department. I have submitted the document we put together for our last review (2006).

**Assessing the Senior Thesis at Carleton College: Strategies and Concerns**

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Part of the graduation requirements at Carleton College include the completion of a "Comprehensive Exercise", fondly referred to as "Comps" by the Carleton community. In true Darwinian fashion, the expectations and nature of Comps has evolved in the semi-isolated local environments of the various academic departments found on campus. In the Geology department, a typical Comps looks a lot like what most would call a senior thesis. That is, original research including the collection and analysis of data, culminating in a substantial piece of scientific writing and a formal public presentation in front of faculty and peers. Because Comps is required of all students, and because we (the faculty) firmly believe that the geology major should be a Liberal Arts degree, we also encourage and embrace alternative models for what a geology Comps should look like. Examples from past projects include the development of teaching modules used in K-12 education, the development and construction of interpretive signs for local, state, and national parks, or the production of an audio documentary on water issues in Minnesota. However, most of our students tend to stick with the more traditional research-based Comps project.

When I came to Carleton in 2002, the Comps process began in the junior year when junior geology majors met with the faculty as a group to discuss potential research options for the upcoming summer such as REU's. Then, during the senior year, we would formally meet three times as a group to 1) have students give the "elevator talk" version of their project, or tell us what they plan to do for Comps; 2) discuss the do's and don'ts of writing science; and 3) discuss the do's and don'ts of giving a science presentation. This worked reasonably well, and mainly consisted of the faculty sharing their wisdom and responding to questions. However, over the past few years our process has evolved and become more structured thanks in part to student response to the Comps process. In addition to the meetings described above, all our seniors enroll in a Senior Seminar course taught in the fall. This course meets once a week and the students use the time to share ideas, write abstracts, make figures, and discuss anything and everything about Comps. An unintended consequence of this course was the start of a new tradition where the seniors meet at a local restaurant for early morning breakfast before class. The other major change is a formal speaker series during winter term where we invite graduate students from nearby universities to give a talk on Friday afternoons. This allows our students to see cutting-edge research presentations and gives us (students and faculty) a chance to discuss what makes an effective presentation. Comps papers are due at the end of winter term (mid March), and students present their work in a GSA-style presentation early in the spring term. We have two readers for each paper, with a primary reader taking the lead in giving feedback during the writing process. The amount of feedback entirely depends the size of the class, and the motivation of the student and their first reader.

So that is our Comps process in a nutshell. The question we as a department continue to struggle with is how should Comps be evaluated? We all think we know good thinking and writing when we see it, but we don't have a formal mechanism for evaluating Comps other than meeting as a group to decide which comps fail (rare), pass (most common), or pass with distinction (less common). We all give feedback to the students, and the students can act on that

feedback and “fix” various problems with their paper before submitting the final version for binding and storage in the library. This works reasonably well, and perhaps we don’t need to change anything. However, some of us have discussed designing a rubric for the Comps paper as a way to organize and perhaps quantify what we consider to be the most important parts of an excellent paper. At first this seemed like a good idea because it might help us see how our curriculum aligns with our expectations for Comps and perhaps give clear guidance to our students. It’s the latter part of these perceived benefits that gave us pause. How do you construct a non-prescriptive rubric? This concern is on two levels. First, we do not want to send the message that one type of Comps is any better than another type (e.g. research-based vs audio documentary). Second, we don’t want students to use the rubric as a checklist, thus putting undue constraints on their thinking, or worse, assume that proper use of the rubric is the true path to distinction. The later might work in some cases, but I can imagine instances where faculty and student interpretations of how well a Comps fulfills the rubric might not align. Therefore, one of my goals for the workshop is to work through some of these issues and learn potential solutions that we might be able to adapt to Carleton.

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February, 2009

**Department of Geosciences**

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# An Attempt at Assessment and Evaluation Using Portfolios

## Our First Attempt

In 2002-03, the faculty of San Francisco State University's Department of Geosciences, led by Karen Grove (former Department Chair), collaborated to develop overall *goals*; a set of six *learning objectives*; and for each learning objective, several *performance outcomes*, for its B.S. program in Geology. (We were proud of these at the time. We still like them, though they need some revision.)

To *assess* the B.S. program, the faculty chose to assemble *portfolios of student work*. We thought that portfolios would showcase what students had learned and allow us to judge both how well they'd learned and how their learning had evolved as they progressed through our program. (We still very much like the potential of portfolios for these purposes.)

To determine which assignments to include in the portfolios, we first considered each of our six learning objectives individually. For each one, the instructor of each of our (then) ten required core courses in geology (but not math, physics, or chemistry) tried to identify one assignment that arguably addressed the learning objective well. Not every core course necessarily had such an assignment, but the instructors for anywhere from one to six courses thought they did. A total of nine assignments were identified for inclusion in the portfolio. Some assignments addressed more than one learning objective; some courses contributed more than one assignment (to address different learning objectives); and nine of the ten required core courses contributed assignments. Most assignments were reports of some type; one consisted of the B.S. thesis and oral defense.

Each semester during the next two academic years (2003-05), students were asked to bring any of the designated assignments that they'd completed to their faculty academic advisor as part of the Department's mandatory advising. The faculty advisors were expected to maintain the portfolios. (This didn't work as well as we'd envisioned.)

To *evaluate* the portfolios, in the summer of 2005 a committee of three Geology program faculty members tried to score the available portfolios, using a rubric based on the performance outcomes for each learning objective. (This turned out to be hard to do.)

After that first attempt, our assessment and evaluation efforts lapsed. We are now reviving them, spurred by an impending deadline issued by our administration.

## What Did We Learn?

- We liked the collaborative process that produced the goals, learning objectives, and performance criteria for the B.S. in Geology program, and we liked the result, at least in principle. (They do need to be revised, for example to include quantitative skills, and fewer performance outcomes might make evaluation easier.)
- The portfolios were incomplete, partly because only nine of the (then) ten required core courses and none of the elective courses were represented, and partly because portfolios were assembled over just two years of a 3-4 year program, but partly because of breakdowns in our assignment collection mechanism. Instructors and advisors didn't always tell students to save certain assignments for their portfolios, or if they did, students did not always save the assignments, or if they did, they didn't always give them to their faculty advisor, or if they did, the faculty advisor didn't always maintain

portfolios consistently. There were no consequences for students who neglected to contribute to their own portfolio or for faculty advisors who neglected to maintain them. The death knell came when the Department lost focus and stopped enforcing mandatory advising, on which the assignment-gathering strategy was founded.

- Our three portfolio evaluators had trouble evaluating the portfolios, because :

(1) The portfolios tended to be incomplete.

(2) Most instructors did not write their assignments (or syllabi) explicitly to tell students (and evaluators) which learning objectives and performance outcomes each assignment addressed, and how. Nor were instructors either strongly encouraged or held accountable to do so. The absence of explicit tie-ins made using the scoring rubric hard.

(3) The evaluators discovered that they didn't really know what to evaluate. Was it: (a) did the assignment address a learning objective (in which case, just one portfolio would suffice); (b) did the students' work meet the instructor's expectations for the assignment and thus achieve the learning objectives implicit or explicit in the assignment (in which case, what could the evaluators add to the grade already assigned); or (c) did the grading fairly reflect the quality of student work (in which case the evaluators might be infringe on instructors' prerogative to adopt their own grading standards). That is, were the evaluators evaluating (a) course and curriculum design, (b) student performance, or (c) instructor evaluations of student performance?

(4) Evaluating the six learning objectives, with several performance criteria for each, was a significant amount of work for which volunteers received no compensation. There was little incentive or real obligation to serve as an evaluator.

(5) The assessment strategy lacked "indirect" assessment data (for example, student or alumni surveys, reflections, or interviews) to measure aspects of our program other than content knowledge and skills.

(6) The evaluation lacked the perspectives of prospective employers, faculty members from other academic programs in geology, and other outside experts.

**Ideas for a Revised Strategy**

A revised and improved assessment and evaluation strategy will need to (1) get all faculty members to buy in; (2) assign a meaningful role for students and make them responsible for it; (3) assign faculty responsibility for implementing the strategy; and (4) more broadly, incorporate the strategy into Departmental culture. We also believe that we need a wider range of assessment data, particularly indirect data, to complement the direct assessment data (student assignments) in the portfolios. Possible steps toward a revised and improved strategy include:

- *Assign responsibility for maintaining portfolios to the students, and hold students accountable for maintaining them. Students would own their portfolios, an employment marketing tool.*
- *Reintroduce a mechanism to enforce mandatory advising each semester.*
- *Assign responsibility for academic advising to one faculty member per semester, and give that person release time to do the work. Among other things, the advisor would monitor student portfolios and make sure they are maintained.*
- *Create a 1-unit, Cr/NC, required course for seniors in their last semester. The course would have two requirements for students: (1) attend Departmental seminars; and (2) meet with a committee of at least two faculty members in a semi-formal context to*

*present their portfolio orally. Committee members would rate the student's presentation, including use and contents of the portfolio, on a Likert scale, using the program performance outcomes as criteria. The course instructor would schedule the evaluation meetings; review results with committee members; distribute, collect, and summarize results of exit surveys, student reflections, and other indirect assessment data; examine assignments in the portfolios and syllabi (from Department files) for evidence that instructors are incorporating program learning objectives into them explicitly; work with instructors who are lagging in this respect; and write a brief summary of the evaluation results for all graduating students, identifying perceived strengths and weaknesses of our program based on the results. The instructor and student-evaluation committee members would rotate among multiple faculty members.*

Outcomes Assessment in the Department of Earth and Planetary Sciences, University of New Mexico: The Past and Evolving Present

The University of New Mexico attempted to initiate a rigorous, meaningful Outcome Assessment policy for all of its undergraduate academic programs in the early 1990's. The faculty of the Department of Earth and Planetary Sciences agreed that the most logical and effective means for the assessment of our undergraduate BS program in EPS was for it to take place in our Introductory Field Geology course (EPS319L), and for the principal instructor (i.e. me) to provide written summaries of each of the UNM BS majors in the course. My assessment of each of our EPS BS majors involved several rubrics, the most important of which focused on the student's abilities to (1) identify, describe, and recognize the importance of specific geologic materials in the field; (2) recognize, describe, and accurately record field relations at hand sample, outcrop, and larger scales; (3) prepare, as accurately as possible, geologic maps and cross sections for each of the mapping projects; and (4) summarize the geology and geologic history of each of the mapping areas as factually as absolutely possible in a four to six page (double-spaced) write up of each of the projects. My assessment typically was one to two pages in length, single spaced, for each student, and they were provided to the Department Chair, who submitted them to the extant "assessment office" for the institution.

The program of undergraduate outcomes assessment at the University of New Mexico ceased to function in the late 1990's, because support for the program was terminated.

Now to the next chapter in the history of Outcomes Assessment at the University of New Mexico. In anticipation of an upcoming re-accreditation of the institution, efforts were made to reconstitute an Outcomes Assessment program at the institution in, to the best of my knowledge, Fall, 2006, during the last year of Professor Les McFadden's term as Chair of the Department. The first phase of the rejuvenated effort consisted of developing OA plans for all of the lower division courses that fulfilled core requirements at the institution. For our Department, the appropriate courses included EPS 101 (Physical Geology, or the Way the Earth Works) and EnvSci101 (Blue Planet). The several faculty instructors for both of these course took their responsibility to develop objectives/goal and then assessable outcomes very seriously, resulting in two very comprehensive pilot OA plans. The next step began shortly before I became Chair of the Department (July, 2007), with the inception of developing OA plans for both our undergraduate and graduate programs. Everyone likes unfunded mandates, in particular when it was at least superficially apparent that the Institution, or at least part of it, really was only going through the motions in the context of the upcoming accreditation (scheduled for April, 2009). That said, the faculty of Earth and Planetary Sciences took the effort as seriously as possible, as we recognized that, no matter what, this effort would be of great benefit to our undergraduates and to at least most of our faculty. Our Undergraduate Committee, chaired by Professor David Gutzler, compiled a draft list of objectives (goals) for our EPS BS, EPS BA, and our EnvSci BS programs. Our Graduate Committee, chaired by Jane Selverstone, compiled draft lists of objectives (goals) for our MS and PhD programs. To my pleasant surprise, especially considering the disparate opinions often voiced by my colleagues at faculty meetings, we rather quickly came to a consensus on objectives for each program. The next step, outcomes, was a bit more complicated, in that several of my colleagues had a very difficult time

recognizing the difference between objective and outcomes; this difficulty is of course exacerbated by the fact that much of the assessment literature appears to confuse the terms objectives, which are goals, and outcomes, which are measurable, at least as our Institution Outcomes Assessment Guru (IOAG) Professor Chuck Paine (English Department) states. So we forged ahead with outcomes, and eventually came to an agreement on the outcomes for all of our programs. I was tasked with preparing pilot assessment plans for all of our programs after the Spring, 2008, semester, with a deadline of 1 June, 2008, right in the middle of my Introductory Field Geology Course. So, the deadline was not met till mid-June. I was told to choose but a few outcomes to concentrate examples of pilot assessment (rubrics!) on, and did so for all of our programs. Actually, and this might be the most important part of my "essay", it was a lot of fun! Ultimately the IOAG and the CARC (College Assessment Review Committee) met and reviewed my pilot examples and provided feedback. This did not take place till late September/early October, 2008, when our attention was turned to the survival of the United States of America. The pilot OA plans were distributed to the entire faculty in mid-October, 2008, which of course was a clear and obvious mistake because individuals who had made no effort to play a role in the process up until this time now decided that they were OA experts and comments, many quite inflammatory, were sent to the entire department. One individual sent out a message to all the faculty late one night that prompted me, as Chair of the Department to print the message and attach a cover memo to the Dean and the College of Arts and Sciences, stating that, unless authorized otherwise, I would NEVER respond to an electronic mail message from this individual. Oh, the joys of OA! I invited the IOAG to our full faculty meeting on 5 November, 2008, and he very carefully explained what the College/institution wanted to see in our revised OA pilot assessment plans. He very carefully emphasized how a few, select outcomes should be targeted for assessment. Fascinatingly, the individuals who were so very willing to speak out via email never said a thing at this meeting. I closed the meeting by saying, "OK, our Undergraduate and Graduate Committees will work hard to take the best interests of the Department at heart in preparing revised OA plans. We can do this, YES, WE CAN!"

On a very positive note, almost all of our revised OA pilot assessment plans, which have addressed all of the concerns of the IOAG and the CARC, have been submitted to the College. OA of all of our programs will begin during the 2009/10 academic year, assuming that the institution, in its near present form, is still in place. The author of this report thanks Professors Chuck Paine, Dave Gutzler, and Jane Selverstone for their tremendous patience, hard work, and collegiality in producing our final OA plans for implementation in the 2009/10 academic year.

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# NSF Workshop: Assessing Geoscience Programs

# Essay: SNC Geology Department Overview and Assessment

## Program Overview

The Geology Department at St. Norbert College is relatively young—the major program was established in 1994 with the hire of a second full-time faculty member. A third full-time faculty member was added in the fall of 2004. All three faculty positions are tenure-track, with two faculty now tenured. In recent years the program has graduated between 1 and 4 majors per year. The department makes a substantial contribution to the SNC General Education program. Most faculty teach at least one introductory geology course each semester, which largely serves non-science students fulfilling their science requirement. Similar to most undergraduate geology programs, we actively recruit new geology majors from our introductory courses. The geology curriculum is typical of most undergraduate programs. A year of calculus, physics, and chemistry is required in addition to a broad selection of geology courses covering the topics of mineralogy, igneous/metamorphic petrology, sedimentary geology, structural geology, and hydrogeology. Two geology elective courses are also required. In addition, majors are required to attend a summer field camp (offered by another institution). The geology department regularly offers field trips, including extended trips over winter and spring break. These extended trips can be taken for course credit.

## Assessment

**Given the relatively small size of the geology major program at SNC, there has been relatively little pressure from our Office of Institutional Effectiveness to establish an assessment program that relies heavily on quantitative analysis of assessment tools. Instead, we have focused on using feedback from four sources to evaluate how we might improve our program in the interest of (1) preparing our students for graduate study, and (2) preparing our students for entry-level jobs in the geosciences (such as in geotechnical firms).**

**Our four sources of information come from the following. First, we routinely receive summary data and comments from the senior exit survey conducted by the College. A number of questions in the survey specifically as about the 'satisfaction' of the students with their major program in areas of courses, resources, and preparation for their careers beyond SNC. Second, we receive data and comments from alumni surveys conducted by the College. These surveys address many of the same questions given in the senior survey discussed above. Third, we have developed our own alumni survey, in which we attempt to gather specific information about the satisfaction of our majors with their education at SNC. We focus specifically on what aspects of the geology major they believe should be modified or changed completely in the best interests of preparing them for their work after leaving the College. We have attempted to give this survey to alumni five years after they leave the College. Finally, we have developed a relatively simple evaluation form/survey for field-camp directors that have our students participate in their summer field courses. Our goal with this survey is to get feedback on how our curriculum prepares our students for synthesizing and applying their basic coursework in field geology. Along with this survey, we ask student's permission to maintain a record of the field-camp grade as a quantitative measure of their performance in field-camp. We do not maintain records of names associated with the grades.**

**We have found that our alumni survey and the field-camp director's survey have been the most useful tools in evaluated our program from the standpoint of modifying specific course content or the curriculum. As an example, a number of**

**students in recent years noted that one shortcoming of our current program is adequate training in optical mineralogy (especially for those going on to graduate research in igneous and metamorphic petrology). As such, we have started to incorporate more training in this area in two majors courses.**

# Assessing a Mid-Sized Baccalaureate through Doctoral Department

William K. Hart, Department of Geology, Miami University (http://www.muohio.edu/geology)

Miami University requires a full assessment of all academic programs on an approximate six-year cycle. Each cycle seems to hold a slightly different theme depending on the administration in place at that time, but the process begins with a "Self-Study" (see uploaded example), which for all departments now includes an assessment of their Miami Plan (liberal education; http://www.units.muohio.edu/led/) contributions and for Ph.D. granting departments includes a section mandated by State guidelines. This is followed by an in-depth, on-site evaluation by a team comprised of two sets of reviewers; one internal and one external. Ultimately reports are written, comments are exchanged between the department and the review committee, and a final summary report is issued by the Provost's Office. Aside from the excellent opportunity that this process affords for internal reflection and assessment of key programmatic features, it also can provide important ammunition for future resource allocation requests.

Obviously the six-year process highlighted above must touch on all aspects of program assessment including, but not limited to undergraduate student learning outcomes from foundation through capstone experiences, undergraduate and graduate student success before and after graduation, program contributions to the university and discipline, program quality and visibility at the national level, and program financial viability. This array of assessment requirements necessitates an array of assessment approaches and tools, for example: individual faculty efforts in specific courses; collective faculty efforts addressing key learning outcomes across the curriculum (e.g. Geoscience Concept Inventory); continual acquisition of student feedback (e.g., course evaluations, exit interviews); continual tabulation and evaluation of quality, productivity, and financial measures (e.g. annual faculty/student activities reports, annual endowment/giving records, comparisons with peer programs) ; and periodic evaluation of alumni feedback (e.g. alumni surveys). Simply put, how well is the program doing in addressing its stated mission(s)?

While there is nothing overly novel about the above approaches, the challenge comes in fostering faculty and student cooperation and establishing a culture of continual self-evaluation that allows accomplishment of the desired assessment without noticeably impacting faculty time and effort; in other words, department buy-in. This is particularly important in a mid-sized Ph.D. granting department at an institution whose primary commitment is to liberal arts undergraduate education (http://www.miami.muohio.edu/president/mission/). Fortunately the university backs up this commitment with resources in support of efforts such as those required for various forms of assessment (http://www.units.muohio.edu/led/Assessment/index.htm) and for creativity and advancement in teaching and learning (http://www.units.muohio.edu/celt/).

As our department approaches the next round of Academic Program Review we do so in a better position than ever before. Why? Some key reasons are highlighted below.

- Faculty, staff, and graduate student annual reports of professional activities and accomplishments are a routine endeavor.

- Quantifiable faculty/staff/student productivity and quality measures have been annually updated and evaluated to facilitate internal and external comparisons and trends.
- Programmatic contributions to the university, community, and discipline have been annually updated and evaluated.
- Graduating students have been surveyed annually (questionnaires and exit interviews).
- Faculty groups and the faculty as a whole routinely engage in discussions of curricular and programmatic improvements and continually seek new ways to involve students in learning outside the traditional classroom setting.
- Assessment instruments to evaluate student learning outcomes are becoming more widely employed across the department's curriculum and programs.
- All faculty have been involved with one or more of the following activities sponsored by the university; faculty learning communities, assessment workshops, assessment working groups, and focused assessment programs.
- All faculty are supporting the department's involvement in a university-wide project (Top 25 Project; http://www.units.muohio.edu/led/Top_25_Project/) to redesign the most popular foundation-level courses in ways that encourage greater student engagement in inquiry-driven learning. New teaching and learning strategies and assessment tools developed as part of the redesign of GLG 111 (The Dynamic Earth) (http://www.units.muohio.edu/led/Top_25_Project/Full%20Proposals/GLG111.pdf) will be extended first to other introductory (foundation) geology courses and ultimately throughout the curriculum.

Assessment at Humboldt State University, Department of Geology

We are in the early stages of developing a formal assessment process. We conducted a Program Review in 2004. Prior to our most recent program review, the department had no formal assessment statement or plan. We have conducted end of semester student-assessed instructor evaluations for many years but had no formal statement of program or student assessment. During the program review we developed a department mission statement and eight outcome goals. We are currently assessing each goal each year. In addition, we developed a graduate survey to assess whether our alumni were succeeding in the workforce or graduate school. We used the AGI statistical standards as the target level to exceed. Finally, we have identified our field camp as the capstone course to assess our student's technical competence in geology. Additionally, at the university-level, a voluntary mid-semester evaluation program is available to all instructors.

We rely strongly on certain aspects of assessment, in particular our surveys of alumni and their employers, to determine how effective our program is toward meeting the needs of both the profession and our graduates. In light of the current tight fiscal environment, this information is important in helping us justify the strongest parts of our program which consist largely of high cost field experiences. We also rely on the end of semester evaluations of teaching to make adjustments to individual courses.

Currently the university is going through reaccredidation review by the Western Association of Schools and Colleges (WASC). We are required by our university to define a mission and goals for all aspects of the curriculum including majors and general education. Much of our assessment activity has been driven by the WASC reaccredidation requirements.

We are still relatively new to formal assessment and are still in the process of identifying obstacles. To date, the two largest obstacles have been the lack of a good template to develop our assessment protocol and a less than enthusiastic response from our faculty about involvement in the assessment process. This is compounded by confusion, at the University level, as to how the assessments will be used. There is a sense among many faculty, and staff, that the assessment is just another paper work requirement that will ultimately not provide demonstrable, useful results.

To date, our first year assessment product, the alumni survey, has provided us with encouraging information about the success of the department in providing strong geology educations for our students. We have a collegial faculty and staff who, although, not wildly enthusiastic about the assessment process, are committed to the best interests of our students and program.

Approximately five years ago, Murray State University embarked on a program requiring departments to develop Assessment methods and instruments for all undergraduate programs. This effort was headed by an Associate Provost, and many workshops, invited speakers and other resources were provided to help launch and coordinate the departmental efforts. Prior to this time, most departmental outcome assessments consisted primarily of written or oral senior exit examinations, and alumni surveys. External review of departments was/is not part of the assessment process. My impression is that most departments did not subject these internal assessments to systematic or consistent review or utilize the instruments very effectively. This was the case for the Geosciences department.

I believe Murray State University' strategy to implement consistent assessment of undergraduate programs was similar to strategies used at many other universities. Faculty responsible for each program were to examine the curriculum, identify some specific learning goals, and develop specific criterion for matching student learning outcomes with the learning goals. The goals were supposed to be connected with broader university student goals; e.g. effective oral and written communication, appropriate use of technology, etc. Senior exit exams could be retained as part of the assessment process. For consistency and ease of tracking, an on-line assessment document was made available to all departments. I have posted a copy of this instrument with my other documents.

A separate Assessment Plan was instituted for each of our departmental majors programs (Environmental Geology, Geoarchaeology, Earth Science, Earth Science Teacher Certification, Geographic Information Science). In a small department like ours, there was of course some overlap between plans. Our department chose initially to focus mainly on freshman and sophomore level courses within each program. The department chair was/is responsible for coordinating these efforts. Tracking is facilitated by the on-line nature of the assessment plans and documents. The assessment program was implemented in the Fall 2005 semester.

I have a few observations. In my opinion, the most useful part of this effort so far was developing the initial learning goals for each departmental major. This essentially necessitated an informal review of each programs' curriculum. This was timely as our department instituted significant curricula changes in 2007. Developing assessment goals also required more sharing of teaching and testing practices information among department faculty. Sustaining and utilizing the new assessment program has been problematic. The Associate Provost who instituted and pushed the assessment program has moved on, leaving at least a temporary vacuum in the

campus-wide leadership of this effort. I have also observed that it is easier to assess student outcomes such as communication skills. In the absence of national or regional normative exams, it is less obvious how to meaningfully assess student success in obtaining important knowledge skills within the geoscience disciplines.

# Essay on assessment of academic programs – some observations

**Darrell Henry, Dept. of Geology and Geophysics, Louisiana State University**

My perspective on assessment of geology programs has shifted to a more institutional view over the last few years. LSU, like many other universities and colleges, was found to be lacking in their approach to the assessment of student learning, not only in geology, but throughout all academic units. As a consequence, our regional accreditation group, Southern Association of Colleges and Schools (SACS), has indicated that the institution must be proactive about assessment of student learning outcomes in all degree programs and all general education courses.

The university responded in a multi-step approach. In 2004, after SACS did the10-year accreditation evaluation of the university there were specific issues that they wanted to have addressed. After several iterations, LSU presented a web-based assessment matrix of the learning objectives, assessment processes and use of results for all academic units in 2006 with the promise that biennial reports on assessment of learning outcomes degree programs and general education courses be furnished starting in 2008. The University Assessment Council (UAC), primarily a group of faculty and Vice Provost for Academic Affairs, was tasked with the evaluation of the entries. I became Chair of the UAC in 2007 and have been meeting with faculty groups to discuss issues of degree program assessment and assessment of gen ed courses. This effort was greatly accelerated at the end of 2008 and 2009 with the goal of carefully examining the assessment procedures used for degree programs and for the >300 gen ed courses. From this experience, I have learned a few things about university-level assessment.

1. Faculty interfacing with the upper administration is critical. The UAC serves as this interface, and the common wisdom and longer vision of this faculty group can put a perspective of what may or may not work with the general faculty at large.
2. Sitting down and talking with chairs and assessments coordinator of academic units generally alleviates much of the concern and generally leads to a workable assessment plan for the unit. The Director of the Office of Assessment and Evaluation, an OAE staff member and a subcommittee of the UAC (including me) has met with a large proportion of the academic units to talk about what they already do and how assessment procedures can be extracted or easily implemented. With any assessment plan, it should be useful to the unit for internal assessment and not just an added paperwork burden.
3. The assessment of student learning objectives should be directly tied in with programmatic assessment. Too often there is a disconnect between these topics, and this becomes most obvious during the accreditation review process.
4. In a given unit, as many faculty as possible should be invested in the assessment process. In our initial review of the biennial report documents, it became obvious that a single faculty member generated the report (Department Chair, Assessment Coordinator, or even an instructor). This process should involve the faculty as a whole.
5. A holistic view of a given unit should involve both direct and indirect assessment of student learning. Most units are accustomed to indirect assessment through instruments such as surveys of students and employers or interviews. Direct assessment can be more of a challenge (see below).

There are a number of useful topics addressed by SACS documents. The following is taken from Strategies for Direct and Indirect Assessment of Student Learning by Mary J. Allen in the SACS 2008 Annual Meeting:

***"Two basic ways to assess student learning:***

1. *Direct – The assessment based on an analysis of student behaviors or products in which they demonstrate how well they have mastered learning outcomes*
2. *Indirect – The assessment is based on an analysis of reported perceptions about student mastery of learning outcomes.*

***Properties of Good Assessment Techniques***

- *Valid – directly reflects the learning outcome being assessed*
- *Reliable – especially inter-rater reliability when subjective judgments are made*
- *Actionable – results help faculty identify what students are learning well and what requires more attention*
- *Efficient and cost-effective in time and money*
- *Engaging to students and other respondents – so they will demonstrate the extent of their learning*
- *Interesting to faculty and other stakeholders – they casr aboutg the results and are willing to act on them*
- *Triangulation – multiple lines of evidence point to the same conclusion*

***Strategies for Direct Assessment of Student Learning***

1. *Published tests*
2. *Locally-developed tests*
3. *Embedded assignments and course activities*
4. *Portfolios*
5. *Collective portfolios*

***Strategies for Indirect Assessment of Student Learning***

1. *Surveys*
2. *interviews*
3. *Focus groups"*

Assessment of students in our department is currently based almost entirely on informal analysis by the faculty. While this works well for the current configuration of our small department (4 faculty and approximately 25 majors), we strive for a more formal venue to examine our students' progress and achievements.

Because we are part of a small teaching institution (~3000 students), faculty tend to teach a broad range of courses throughout the year. Individual faculty usually teach two required core requirements in a year-long sequence (e.g. mineralogy-petrology). This provides an excellent opportunity for us to determine the extent to which material was retained from the first course of the sequence and reflect on which of the outcomes were met with the best success. Unfortunately, the size of our department acts as a hindrance as we typically teach core major courses on an alternating year schedule.

We also have a cross-departmental natural sciences seminar, in which all of our seniors participate. This senior seminar is an excellent opportunity for our students to demonstrate their geologic knowledge, and provides us with a measure independent from regular coursework to evaluate our students near the end of the academic journey here at UH-Hilo.

Recently, we redesigned our alumni webpage in an attempt to gather significantly more information about our students. Our alumni survey results will be complied on the departmental webpage. While there is an inherent bias to positive views, as these students are more likely to respond, we get a decent measure of how well-prepared students feel for success, whether in graduate school or in a career. We have been informally collecting this information for years, but are making a concerted effort to reach all of our alumni.

As we move to more formalized assessment, there are a number of questions that we ponder:

- What should a geology graduate look like?
- How does our geology core curriculum compare with other programs?
- What standards should we strive to meet?
- Is there an effective way to implement a capstone experience such as a senior project (thesis) that will not disrupt our current teaching loads and courses?
- How will our assessment data change the way we operate? Will we modify course offerings or programs based on the data?

In summary, we feel current informal assessment of our students is a reasonably reliable estimate of how well we are serving them. In order to improve our understanding of the department's effectiveness, we hope to introduce assessment activities that provide pertinent and adequate information for our department.


# Assessment in the Geology Department at the University of Dayton

Assessment practices in the Geology Department at the University of Dayton must be considered in light of the intersecting but distinctive missions of the Department, the College of Arts and Sciences, and the University. UD is a Catholic institution founded in 1857 by the Marianist Order, and it continues to have a strong Catholic and Marianist identity, with approximately 70% of its students coming from Catholic families. The Marianist charism emphasizes values of community, welcoming and inclusion, service, strategic adaptability to evolving times, and practical wisdom that support an open, inquisitive and engaged academic environment. UD is a regional, comprehensive university with an undergraduate student population of approximately 7000, approximately 3000 of whom matriculate through the College of Arts and Sciences which is conceived as a Liberal Arts college within the framework of a comprehensive university that also includes professional schools of Business Administration, Education, Engineering, and Law. In recent years the University has enjoyed significant success in enhancing its selectivity, raising its national profile, and enhancing its reputation as a leader in American Catholic Education.

The Geology Department at UD graduated its first majors in 1949 during the post-war expansion in education, and through most of its history has focused on offering a strong undergraduate degree program, which in the early 1990's was expanded to include a major in environmental geology. Historically, the UD geology program has been small but rigorous, with a focus on preparing students for graduate study. In the 1998 Franklin and Marshall study of the Baccaulaureate Origins of Doctoral Recipients, UD ranked first among Masters degree granting institutions in the number of its graduates who went on to earn doctoral degrees in the Earth Sciences.

In the past fifteen years the faculty has grown from three tenure line faculty and one part-time lab instructor to six tenure line faculty with a full-time lab coordinator and four part-time instructors. Much of the growth has been driven by the department's support of the Common Academic Program at the University. In addition, the department is on the verge of launching its first foray into the graduate realm as it develops a certificate program in Geographic Information Systems. With the growth and evolution of the departmental mission, the time is clearly ripe to reconsider how we assess ourselves.

Despite the growth in the department, we continue to have a single administrator, the chair, who is supported by just one administrative assistant, so it is imperative that assessment strategies provide meaningful data on departmental functioning without undue added burden on the already fully deployed administrative staff and faculty. Though many of our students enter the workforce directly, we continue to view how well-prepared our graduates are for graduate study as a key benchmark in program assessment. Simultaneously, we see a need to establish and expand relationships with the regional business community and public agencies that employ graduates in geology, and we need to form a "board of advisors" who could contribute to the evaluation of our programs. Finally, we have been exploring the establishment

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of a "second-year review" process to assess our students early in their careers in order to target areas in need of remedial attention (both individually and collectively). As we develop this process we need to consider how it can interface with department assessment.

In May 2007, the University passed a new assessment plan based on seven broad outcomes known as "Habits of Inquiry and Reflection," to wit: Scholarship, Faith traditions, Diversity, Community, Practical wisdom, Critical evaluation of our times, and vocation. It is not expected that every unit will be responsible for realizing each of these outcomes, but each unit should demonstrate how they contribute to a subset of these broad outcomes. The College of Arts and Sciences has responded by directing each of its departments to review and revise their assessment plans in light of the above broad institutional outcomes as well as in the context of their own distinctive departmental missions. We are not expected to assess every element in these plans each year. However, all pertinent areas need to be assessed at least once within a departmentally-defined review cycle that might be on the order of 3 or 4 years. Building these assessment plans is viewed as a multi-year process. In 2008, each department was charged with devising a plan to assess at least one broad outcome from the seven listed above, and in 2009 we are tasked with collecting initial data to assess the selected outcome(s). By 2010 we will need to complete our plan which will then be implemented through a multi-year cycle of annual assessments.

For our initial round of assessment we chose to focus on two outcomes: "Scholarship" and "Practical Wisdom", though there is still an opportunity to amend and improve our initial draft plan to assess our performance in these areas. Our past assessment plan, in my opinion, was poorly designed as it focused almost exclusively on an exit survey completed by graduating seniors, and the statements on that survey, though pertinent are over-generalized and unduly subjective, for instance, "As an undergraduate in the Geology Department of the University of Dayton I believe I am adequately prepared for graduate school." Nevertheless, the existing framework does have an advantage in that it is simple and easily executed, and it provides a source of longitudinal data to gauge our progress over the past 10+ years. The revised plan calls for continuing the use of the current survey, though perhaps expanding it to provide more meaningful results and supplementing it with additional data to provide more objective measures. For instance, the revised plan calls for tracking the number of graduating seniors who complete theses or independent studies and/or present research at conferences or at UD's annual campus-wide research symposium. In addition, we plan to add a follow-up survey of alumni three years after their graduation and we plan to track the proportion of our students who go on to graduate programs or careers in geology within three years of graduation. In addition, we plan to begin tracking the proportion of our students who have summer research, service, or internship activities. At present we have not contemplated instituting comprehensive exams for graduating seniors, but we would be interested to learn of the experience of others along those lines.

As we move forward with the completion of our assessment strategy some of the most challenging work lies ahead. The College and University do not require us to assess all outcomes listed in the Habits of Inquiry and Reflection document, but we believe that most do in fact have some significant relationship to departmental mission, with the possible exceptions of "vocation" and "faith traditions." (Although even in that case, one could argue that a geology department has a significant role to play in the general education curriculum in defining the boundaries and distinctions between science and faith-based inquiry, and the value of not "blurring the lines" between them). There is a certain comfort level in assessing our performance in scholarship and development of the practical wisdom of our students, but how do we evaluate our progress in supporting the growth of our students with regard to their appreciation of diversity, the health of our department as a community of learners, and the ability of students to engage in "critical evaluation of our times"? What does it mean to be "called" to be a Geologist, and how do we gauge our students' understandings of Geology as a 'calling' (i.e., vocation)? I have some preliminary

thoughts, but am hoping that discussions at this workshop may yield fresh insight and perspectives as well as practical suggestions as to how to proceed in interweaving our departmental mission and objectives with overarching University imperatives.

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## Assessment in the UVM Geology Department

We assess at a variety of frequencies and scales. What follows will be a review of some our approaches, from the almost daily in-class assessment of student learning to the infrequent longitudinal surveys of alums.

With only one or two exceptions (those of us that have participated in Cutting Edge workshops) our faculty are very traditional in their assessment of students. Most give standard exams. Fortunately, with the exception of one introductory lecture class, these exams are NOT multiple choice or T/F but are problem-based. Several junior and senior level classes involve term papers. One of our more pedagogically innovative classes is a large introductory class in earth system science. Although the lecture is fairly traditional (predominantly lecture with some demonstrations, think-pair-share questions, etc) the labs involve student working groups on field trips, construction of concept maps, and a lab portfolio. The portfolio asks each student to identify common themes to the semester's labs as well as address a question that asks the student to contextualize the material. An annoying challenge is developing new innovative portfolio questions every year so that the portfolio essays can't be retrieved from "frat files." I strive in this class to align the assessment vehicle with the student learning goals and also to insure that the students have practice with the type of assessment vehicle before it "counts."

The student learning objectives for both the B.A. and B.S. degrees include the development of written communication skills. The "writing across the curriculum" (WAC) has been active for many years in the College of Arts and Sciences. Most of the older geology faculty (practically all of whom are now retired) participated in this program and incorporated a variety of strategies in their courses (multi-draft, peer review, portfolios) to improve student writing. In the past five years I've found less interest on the part of my colleagues in doing this because they feel it takes time away from content and there is still a perception that writing should be taught by the English department. Attendance at WAC workshops has evaporated, replaced by an assumption that more writing equals better writing. I'm hopeful that the capstone experience we've created will provide us with meaningful feedback about student writing, and we can have a meaningful discussion on how to improve writing with our assignments.

Course evaluations are required (by the Department) for every class we teach. The course evaluation is constructed around the student learning goals that are articulated in each course syllabus. These course evaluations are the focal point of discussions between the Chair and each faculty member in the spring. Department average values are calculated and these averages are used for the Chair in preparation of faculty portfolios for reappointment and tenure. Consensus among faculty came fairly easily during the development of this common course evaluation form and I think it works pretty well.

More recently we have tried to develop assessment metrics for graduating seniors. Because we offer three degrees (B.A. Geology, B.S. Geology and B.S. Environmental Science, Geology concentration), and only two of these require at least 3 credit hours of undergraduate research, evaluating what our graduating seniors know varies. For the students who have done research (about half the population) the quality of the written document and public presentation are the vehicles for assessment. The B.A. students, for whom research is only recommended, not required, we've had until very recently no assessment mechanism. Only last year did we develop a senior seminar capstone experience which this year has only 2 students enrolled. We've been really constrained on what type of capstone experience to develop because of resource constraints (faculty time) so we created a seminar based on something we were already doing, a visiting

speaker series. B.A. Geology majors are required to attend the visiting speaker series (about 5 or 6 a semester) and at the end of the year, write a paper which synthesizes what topics were discussed at these seminars with what they learned in the geology classes they took over their four years. I have no idea if this will be effective in getting students to synthesize and reflect, but at least we will be able to evaluate if they can write. I should say that I had to drag my department to and through this process. Only one or two other colleagues were actually interested in assessing what our graduates could do. Because many colleagues are focused on their research programs they felt comfortable with what their undergrad research advisees could do and wanted to leave it at that.

Assessments are meaningless if you actually don't examine the results and modify what you are doing. That is the problem we will face as the capstone experience we've created for the B.A. non-research students runs for a few years. At this point in time the faculty do not seem interested in examining the results, but since this lies in the future, we'll see what happens down the road. As part of the UVM re-accreditation process we have committed to having an annual faculty meeting devoted to review of assessment data, but I'm not sure how we are going to do this because overall interest in the process is low.

On a very infrequent basis we solicit feedback from alumni. This longitudinal survey is really only done when we have to have data for program review. Since we went through such a review relatively recently, we conducted this survey. In constructing questions for this review I was interested in two questions. First, we were trying to find out if our alumni were engaged in careers related to the earth and environmental sciences. Second, we were interested in whether student evaluation of their experience in the geology department differed significantly from their perception of their overall UVM experience (anecdotally I had heard that UVM alums were highly loyal to individual faculty and departments but much less so to the institution). The results confirmed this to be the case.

In sum, most faculty assess student learning in the classroom in very traditional ways. Faculty have "bought into" our revised course evaluations, in part because they really do care about delivery of their material and these evaluations are part of the annual review process. As you get further away from what is of immediate interest to a faculty member their interest in assessment wanes. This is my department's big challenge.

**Essay for Assessment Workshop**
**Stephen O. Moshier, Chair and Associate Professor**
**Geology and Environmental Science Department**
**Wheaton College, Illinois**

**About five years ago our College accreditation review resulted in a positive endorsement, but a warning that our school had not yet developed "a culture of assessment." We understood that this critique was common at the time and assessment remains an ongoing struggle for higher education, to wit, this very workshop on assessment for Geoscience departments. We were given two years to develop a document in order to satisfy our accrediting agency. Our Education Department provided leadership across campus, as they seemed to "get it." An annual Faculty Development Day was devoted to presentations and breakout sessions on how to assess our programs. We rolled up our sleeves and calibrated our assessment instruments with words like "pedagogy" and "rubric" (words not typically uttered by scientists who think instruments are used to measure isotopic ratios). The crisis was averted when our institutional document was approved at the end of our probation.**

**So many different approaches to assessment offered as examples actually made it difficult to know which ones were most appropriate for our program, and it's disparate parts. We tended to force existing models to our courses rather than develop instruments that emerge more organically from them. If I described here what we developed, our effort would probably sound familiar to everyone in the workshop: collections of specific assignments keyed to learning objectives, overall class performance on selected exam questions, pre- and post- course exams, etc.**

**Our college had already a tradition of self-study and external review for every department. Our Ten-Year Review process was established in order to "evaluate departmental strengths and weaknesses in the areas of curriculum, teaching, advising, and facilities, and to provide recommendations that would strengthen the overall program." It remains a mystery to me why our accreditors did not value this process as strong evidence of "a culture of assessment." Granted, a decade between reviews can miss pertinent and even persistent problems in fulfilling a department's mission, but the entire affair amounts to more than one semester's worth of effort to gather documents, retrieve surveys from students, alumni and other members of the college community, and invite the inspection of three outside reviewers (two from off-campus and one from another department on campus). These reviews are particularly helpful in highlighting for administration real and vital needs of the department (not just the whining that every chair routinely does to get attention). For example, as our department underwent revitalization in the early 1990s, our ten-year review showed specific deficiencies in**

**facilities that resulted in almost immediate renovations of our space. An outsider reviewer can look at a Dean straight in the eye and say, "yes, they really do need that!"**

**Our plan rightly points out (with credit to my colleague and previous chair who assembled the plan) that a traditional geology education offers unique opportunities for learning synthesis and assessable outcomes, namely, field camp and capstone seminar. Good ol' Summer Field Camp comes midway or late in the program, so students are forced to do integrative thinking to complete projects. Knowledge from stratigraphy, structure, petrology and more is applied to interpret local geology and make maps. Accompanying reports must communicate information with sophistication and technical style. Our liberal arts curriculum requires a capstone seminar for every major. In our capstone, geology seniors are given several opportunities to think through and communicate how their entire education fulfills the college mission statement. In three writing assignments they are asked to place their geological education in the context of a Christian worldview in the areas of professionalism, environmental stewardship and origins issues.**

**Now that our department assessment plan is in place, our problem is in actually doing what we promised and keeping the plan up to date. As I read over our plan (that is only 5 years old), I note that some of the assignments keyed to certain objectives are no longer assigned in some classes. Some of my colleagues are not willing to go through the routine every year, so there are gaps in the records. I have found that some of my assessment goals were set so high that the numbers indicate I am falling short (and that just can't be the case, right?). It is time for us to assess our assessment.**

I should begin by saying that I have limited experiences with the assessment of our undergraduate program, but I have served on the assessment committee for our graduate program. My background to our undergraduate program is limited to the information provided by our Assessment Committee and is as follows:

The Assessment Plan for the Geology program has recently been revised. Previously, assessment of the Geology program was done in two different ways, one formal and one informal. Formal assessment was a two-part written (value added) assessment instrument for testing freshman and seniors. The first part involved a written self-assessment of student competence, ability, understanding, or skill relevant to the geologic profession and is consistent with our program objectives. The second part was a multiple-choice exam, with questions ranging from basic knowledge to synthesis and interpretation.

As a baseline, several sections of Geology 105 (Introduction to Geology I) and/or Geology 102 (Principles of Geology) were tested annually, whether or not any of the students are declared Geology majors. All majors are given the same test near the conclusion of Field Geology, our capstone course. This constitutes our measure for baseline and value-added data.

In addition, a third part of the formal assessment was a form on which faculty rate each student for 12 abilities critical to the professional practice of Geology. The evaluation took place during the capstone course, Field Geology, wherein faculty members spend six weeks working directly with the students in the field. This course involves application of skills, collection of data, synthesis and analysis of information, and presentation of results as maps and cross-sections. This provides as insightful an assessment, student by student, as is possible by any assessment option.

Our current assessment plan has four components. They are:

1. A report that is embedded in GEO 396 Field Geology. The report is designed to assess the major goals of the program. Students complete the report while at field camp. This project was administered for the first time in June 2004.
2. A student portfolio. Students generate a portfolio by accumulating course work that highlight how they believe they have reached a goal. All majors are asked to continue to compile and regularly update a portfolio of their work in light of the goals. Students rarely submit portfolios, which makes this assessment tool difficult to use.
3. An evaluation of oral communication skills that is embedded in the research project that is associated with GEO 296-Sedimentology.
4. An exit interview designed to have students recollect their experiences. The interview is conducted by the Geography-Geology Assessment Committee during a student's final term in residence.

Within the graduate program, we use two forms of assessment 1) a report in our capstone course, a three-week field course and 2) exit interviews.

The report is designed to assess how students apply theoretical concepts to a real world scenario. Over the years, the project has evolved as the faculty came to realize certain goals were not being assessed through the report. The current structure

of the report focuses on the main goals of the program. We use the assessment data to modify our graduate curriculum to better serve the students. If goals were not being meet, faculty alter course content, projects, delivery mechanisms, etc. to better convey the topics.

The exit interviews are conducted by a graduate faculty member other than the student's main advisor. The interviews are designed to solicit student feedback concerning their perception of how the programmatic goals were met. The results have helped the faculty understand how students receive the content of the courses and whether the student's perception of a course meeting programmatic goals is correlated to actual achievement of meeting of the goals.

**Assessment in Geology & Environmental Science at James Madison University**

The Department of Geology & Environmental Science at James Madison University is a large among undergraduate departments, with 14 tenured or tenure-track faculty and approximately75-80 majors in two degree programs. Within the College of Science & Mathematics, however, it is the smallest in terms of faculty but equal to the Physics & Astronomy Department in the number of majors. Geology faculty, however, provide at least 50% of the student credit hours within the collage generated for science coursework in the general education program. As a result, the assessment of department activity relative to teaching and learning is an important factor in program evaluation.

In the most recent past, assessment within the Department of Geology & Environmental Science at James Madison University has been defined in the broadest terms. In the absence of a set of standards provided by a professional society, this may not be uncommon among geoscience departments. Assessment has been confined to measurements relative to either (a) specific course goals, and student mastery of these goals, or (b) confined to general statements about the needs of the programs and department vision statements. These data have been more retrospective and provide less information on future directions than one might expect.

**Goals & Objectives**

As a part of the development of our Academic Progress Report during the 2007-2008 year, program objectives were carefully examined and vetted amongst the faculty. General program goals and objectives for JMU Geology & Environmental Science degree programs were developed. The sub-committee charged with defining the goals and objectives also defined specific goals and objectives for degree candidates, such that a general set of expectations that reflect the cognitive, affective, and psychomotor (skills) domains could be applied in a measurable manner. As applied to degree candidates, the attainment of these goals would represent the satisfactory completion of a program, and a primary avenue by which the success of each program might be evaluated.

There is a general recognition among faculty in the department of the importance of Cognitive, Affective, and Psychomotor (skills) objectives in the degree programs. These objectives have been mapped through a set of matrices, stipulating in what courses the knowledge, skills, and dispositions are introduced, reinforced, and subsequently built upon. Faculty members were asked to define the core courses that they are responsible for in terms of the subset of the knowledge/skills/dispositions most appropriate to the course. These data are being compiled currently, with a new assessment committee charged with this task.

**Assessment of Students in the Department**

The actual number of geosciences degree candidates in any given year has been relatively small compared with other majors. There is relatively little literature on program assessment practices in the geosciences, and the professional societies have not developed a standardized set of instruments to provide such information. Given the complex and interdisciplinary nature of the geosciences, especially as applied to our programs, it became evident that a performance assessment protocol was desirable. Therefore a performance assessment for all majors was developed, to represent components of the cognitive, affective, and psychomotor domains. In developing a rubric in conjunction with this protocol, it was anticipated that levels of performance would reflect introductory, transitional, and expert level among participating

students. The assessment protocol was piloted JMU Assessment Day 2008, with all BS and BA candidates strongly encouraged to participate in a performance assessment task.

The objective mapping exercise contributed substantially to the development of this performance assessment protocol, whereby students at different stages of degree progress are expected to perform at differing levels of expertise. This protocol provides a visual representation of a geologic situation, a verbal description, and allows access to samples of materials for the site. Students are to provide written responses to a set of prompts, asking for information expressing declarative and procedural knowledge, habits of mind, the application of skills, and the clear communication of each aspect. This protocol was initially piloted at the JMU Assessment Day in 2008, and participation will be mandatory for students in 2009. Preliminary analysis indicates that the general premise of documenting student development through in this manner is valid, although reliability is receiving a close examination between reviewers.

**Other Sources of Data**

The General Education testing program at JMU has been able to provide little data to the department, as often too few department majors are selected to take the Cluster 3 – Scientific Perspectives examination on Assessment Day on a given year to have statistical meaning. These assessments are administered by the JMU Center for Assessment and Research Studies (CARS) on the second Tuesday each February. Students that have not yet completed 70 hours are required to participate in Assessment Day, randomly selected to take an examination in 1-2 of the General Education program clusters. As an ethical issue, however, it is the policy of CARS to not release data related to the instruction provided any individual faculty member or department. Thus, data that is tied to a large portion of the instructional activity of the department is not available for program assessment or evaluation, for either department majors or for general education students.

As a primary data source, student evaluations of instruction (SEIs) have traditionally been used to gauge the value of instruction in a particular course, and implicitly the efficacy of faculty members in delivering that instruction. That said, the direct utility of SEIs is limited by the reflective nature of the questions, the range of student performance in a class, and the immediacy of student experience in an individual class relative to an overall curriculum, such that students only see the "trees" and not the "forest." The development of this instrument continues, with an analysis of individual questions, as well as a means by which the somewhat complex nature of some of the item responses may be best presented.

One area of attention can be specifically linked to science teacher education. JMU has a history of teacher education as the former public normal school for Virginia. As a result, teacher education captures a large share of majors at JMU to this day. To maintain accreditation, the College of Education at JMU undergoes periodic review by NCATE, which assigns the review of science teacher education programs to NSTA. The standards established by NSTA specify a clear and explicit role by content departments be documented, in terms of establishing the competence of teacher education candidates in content knowledge as well as the skills and dispositions that are valued within the discipline. This is a current focus of department assessment activities, one that will remain a challenge in the near future, but one in which the department has taken a clear lead within the College.

# Assessment Essay

Sheila J. Roberts
Department of Geology
Bowling Green State University

The Department of Geology at Bowling Green State University offers a MS in geology and a BS and BA in geology. There is also a specialization in paleobiology for the BS students. Several years ago, we identified learning outcomes for both the graduate and undergraduate programs. Sometime later, we devised the methods to assess these learning outcomes. You can see our learning outcomes and assessment methods under Assessment Instruments.

For the **undergraduate program**, we identified 4 learning outcomes:

- Identify, describe, and classify earth materials, formations, and structures and interpret them in the context of geologic processes
- Analyze and report quantitative geologic data collected in the field and laboratory
- Read, write, present, and critically evaluate geologic reports, professional papers and maps
- Synthesize information from a variety of disciplines to solve geologic problems

We also identified the courses which would be used to assess each learning outcome. For example, the second outcome is assessed using selected exercises from homework assignments in our quantitative methods, structure and tectonics and summer field courses. It has, however, been difficult to quantify the learning outcomes and use the results of assessment to improve our undergraduate program for a few reasons.

First, because of a low number of majors, we are only able to offer our required courses every other year. Therefore, some students will take quantitative methods before structure and tectonics and others will take structure and tectonics before taking quantitative methods. Therefore, we cannot compare the assessment of the quantitative methods course (which, in an ideal world, would be taken by students first) with the assessment of the structure and tectonics course to see if the students are making progress toward the learning outcomes.

Secondly, each faculty member assesses the learning outcomes using a different scale, making comparison difficult. To overcome this difficulty, we developed rubrics to use in assessing the learning outcomes. For example, for the second learning outcome, students should be able to: Interpret graphs and charts of quantitative data; Interpret basic statistics; Select data collection and analysis techniques appropriate for problem; Integrate quantitative data from multiple sources and/or sub-disciplines in geology. We have not yet implemented the rubrics.

Graduate students are required to complete course work, write and defend a thesis proposal, and write and defend a thesis. The department identified four learning outcomes for the **graduate program**:

- Possess knowledge at the graduate level of several areas within geology.
- Possess an in-depth knowledge in the student's area of specialization.
- Possess the ability to design and conduct an original geoscience research project, with appropriate use of the scientific method, robust sampling, and analytical methodologies.
- Possess the ability to justify and communicate the results and interpretations of an original geoscience research project.

The learning outcomes are assessed by students' performance in graduate-level courses and their performance on the written thesis proposal and thesis and on the oral defense of the thesis proposal and thesis. We agreed on an evaluation form (see Assessment Instruments) for the written and oral presentations based on a form used in another department, which was in turn based on the work of the Carnegie Foundation's "*Scholarship Reassessed*." Using this form, we are able to quantitatively compare a student's performance on the thesis proposal (completed at the end of the first year) and their performance on the thesis (ideally, completed at the end of the second year). Based on this analysis, we have identified some weaknesses in our program (e.g. students have difficulties doing background research on a topic) and are working to address them.

NDSU Geosciences Assessment of Student Learning

The University's Office of Assessment requests annual reporting of assessment of student learning. NDSU provides an assessment web site at
http://www.ndsu.edu/accreditation/assessment/index.shtml
that includes information and forms to be submitted with annual reports. These include guidelines for reporting assessment activities, a tool for self-reporting levels of implementation of the department's assessment plan, a list of direct, indirect, and non-measures of student learning, and a rubric for how the assessment report will be evaluated. These extensive resources have provided the department with ideas for developing a plan. What is still needed is an efficient implementation that results in information that benefits the needs of the Office of Assessment and the Department.

The Department's assessment protocol is currently under development and in draft form. It has been based on one developed by the Department of Plant and Earth Science, University of Wisconsin-River Falls, with permission. The UWRF plan is available at http://www.uwrf.edu/pes/geol/assessment.pdf .

The major sections of the current assessment protocol includes definitions of the program learning outcomes, and a curriculum map showing in which courses the identified learning outcomes are introduced, emphasized, and reinforced. For each learning outcome, other activities which promote that outcome are listed, as are methods to determine whether the outcome has been achieved, and a timetable.

Rice University Earth Science
Essay on Program Assessment Experiences
Dale Sawyer, Professor of Earth Science
19 February 2009

Explicit learning objectives, assessment tools, and evaluation plans, became part of our world at Rice University about 3 years ago. The change was not welcomed by the faculty. The change was driven by a coming reaccreditation review, and the realization that the university had ignored the instructions of the prior accreditation that such a system be put in place. The university's first effort was low key and generally unsuccessful. The faculty in each department charged with this process had little idea about either the language or the process of program assessment. Most faculty resisted strenuously, arguing that they knew what a good degree program was and that they do not need a "process" to improve what is currently in place. The prime exceptions to this were the engineering departments, which were accustomed to ABET certification procedures.

Then the accreditation review began, and we were found to be seriously deficient in this area and were instructed to remedy the situation quickly. A new, high level, administrative position in Program Assessment was created and a hire made. What followed was a gradual implementation plan, which called for annual small steps toward a comprehensive plan. The first year, each dept. was asked to define one learning objective and assessment plan for <u>one</u> of our degree programs. These were reviewed, changes suggested, improvements made, and then accepted. The second year, each dept. was asked to report on data collected (during that one year), data evaluated, and actions taken for the one learning objective for one degree program. They were also asked to define one new learning objective and assessment plan for <u>each</u> of our degree programs. That brings us to the present.

The Earth Science Department at Rice offers 4 degrees: BA Earth Science, BS Earth Science, MS Earth Science, and PhD Earth Science. The BA degree is rarely (one every 4 years or so) sought by students, so it is not too important to our thinking. We average 8 BS students per year, and they mostly go on to graduate study at first tier research universities. We average 5 MS graduates per year. Most seek employment in the energy or environmental sectors. We average 8 PhD graduates per year. About half seek academic positions and the other half seek positions in the energy and environmental industries. I have submitted the current versions of our learning objectives and assessment plans to the workshop site for such material.

We are fairly comfortable with the learning outcomes that we have designed for each of our degree programs. They were built after perusing similar documents from other research departments around the US.

We are fairly uncomfortable with the strategies that we have identified for assessing the learning objectives for our degree programs. Historically in our dept., program

assessment has been done by informal discussion among faculty and largely uninformed by data.

One area, where I think that we are on the right track is the evaluation of communication skills for our graduate degree programs. We require each of our graduate students to prepare an annual report on their activities and submit this to our Graduate Committee. This report includes citations to all written and oral scientific presentations by the student. We consider the presentation of a poster or oral presentation at a regional, national, or international meeting to be a strong indicator of a student's communications skill. We consider the submission of a manuscript to a major scientific journal to be even better. Since this information is reported by the students, it is easy for the Graduate Committee to assess our progress toward more student presentations and more publications. As we have tracked this for several years, we are indeed seeing that the culture of scientific presentation and publication is growing in our students. We think that this is good. A key to the success of this assessment strategy is that the reporting work is distributed among the students themselves.

We have struggled with finding other strategies to assess other learning objectives. I hope to learn about other successful approaches at this workshop.

**Meaningful, Informative, Simple: The Elusive Goals of Program Assessment at West Chester University of PA**

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We began the struggle to assess our geoscience programs back in the 1990's. Our department offers a B.S. degree in geoscience and a B.S.Ed. degree in Earth and Space Science. We created an assessment plan including a portfolio of student work from selected courses with a reflective essay written by the students during their senior seminar course. This plan proved to be unworkable: the logistics were too complicated and we hadn't thought through our specific learning outcomes and how they would translate into effective rubrics for student work. Before the plan could be revised, the department made substantial changes to the curriculum, eliminating some of the courses which were critical parts of the assessment plan.

Meanwhile, our attention shifted to assessing our introductory-level General Education courses. The University had established seven goals of general education, of which each department had to select three goals. The three goals we selected (in brief, quantitative skills, critical thinking, and "scientific understandings"), had a number of specific outcomes that could be assessed. We currently assess four introductory-level courses: geology, astronomy, meteorology, and "Humans and the Environment." We use a common, simple rubric to assess specific student products, such as questions on an exam, for each goal. This is a summative, not a formative assessment. The instructor(s) of each course writes the questions and assesses the students' work. The rubric for program assessment is different from the instructors' grading for the course. In courses that have multiple sections, instructors use the same questions and the same rubric, although the syllabi, textbooks and labs are different. All data are submitted to the University in aggregate. We also use an anonymous survey asking students at the end of the semester how well the course met general education goals. The general education assessment has been successfully administered for 3-4 years. Results in the first year showed that: 1) we needed to improve our teaching to build students' quantitative skills; and 2) we needed to discuss the general education goals with the students. Both improvements were instituted and we have met our targets in subsequent years. Within the past two years, the University has begun its own assessment of the general education goals, and their interest in departmental assessment of general education courses has diminished to the point where we are no longer required to submit data. So we find ourselves re-thinking the purpose of our general education assessment.

In my opinion, our department's general education assessment has taught us some important lessons for all future assessment:

- One of the most important roles of assessment is that it forces faculty to articulate course goals and learning outcomes, and to discuss those with the students. More than one of our faculty has commented that the general education assessment helped them improve their course syllabus and communication with students about our department's mission.
- Outcomes being assessed need to accurately reflect the course goals, content, and delivery. We have found large differences in performance on some questions among students in different sections of the same course. In general, students in the sections taught by faculty who wrote the assessment questions perform better. We don't have any other data that suggest some sections are not being taught well; instead, there seems to be a mismatch between course content and teaching methods and the specific questions being used for assessment.

- The right balance has to be struck between meaningful data and simple data collection. Faculty teaching some general education courses insisted on using essay questions, rather than multiple choice questions, for assessment of critical and analytical thinking. Because this is more time-consuming, these data were not gathered some years when the instructors lacked time to complete the evaluation. Rather than having "better data" we have no data at all.

At the same time the general education assessment was progressing, the University was undergoing NCATE accreditation for its education programs, including our B.S.Ed in Earth and Space Science. A requirement was an extensive assessment of the B.S.Ed. program and student performance, which was reviewed and finally approved by the National Science Teachers Association (NSTA) in 2008, thanks to hard work by Dr. Steve Good in our department.

We are now working on a new assessment plan for our B.S. Geoscience degree program. We will make it parallel to the B.S.Ed. assessment, since both programs share common core courses and some of our majors transfer between programs. The B.S.Ed. assessment includes two items that are part of the new B.S. assessment plan: a student survey with items that are directly linked to our program goals, and a rubric for evaluating student performance on significant research assignments. The B.S.Ed. program assessment is based in part on the Competencies (content knowledge and skills) established by the NSTA, so these Competencies are part of the B.S. assessment, as well. Our current curriculum was devised to meet the course requirements for the Professional Geologists certification by the Association of State Boards of Geologists (ASBOG), because many of our majors ultimately obtain this certification. The ASBOG test blueprint items for the Fundamentals of Geology exam provide another set of student learning outcomes. We have created a matrix showing which of our courses potentially "cover" each NSTA Competency and ASBOG item. However, the NSTA Competencies and ASBOG items provide far too many outcomes for student learning assessment at the course and program level.

I come to this workshop with questions about my department's assessment plans:

- What do we want or need to know about our existing program to make it better (and what do we mean by "better")?
- How can we explicitly connect our department goals (which are pretty broad) with what the students are doing in our courses and in extra-curricular opportunities?
- How can we distill the broad department goals, and the numerous too-specific NSTA Competencies and ASBOG items into a small set of manageable student learning outcomes?
- What kinds of information can we collect from our students about these learning outcomes that will help us to improve our program?
- How can we implement a plan that will be simple enough to be sustainable, while collecting meaningful data that will tell us what we need to know?

Winona State University (WSU) Geoscience Program Assessment – Our evolution:

The Winona State University (WSU) Geoscience program has been wrestling with assessing our curriculum and program effectiveness for the better part of the past decade. We began our work in earnest in the spring of 2003, motivated by the arrival of two new colleagues (representing 50% of the faculty). As the department has grown and the curriculum has evolved, our assessment strategies have likewise evolved.

WSU enjoys an institutional culture that embraces assessment. The institution hosts an annual "Assessment Day" early in the spring semester (mid-February) for which all classes except those with only one weekly meeting (including laboratories) are officially cancelled. The day is divided into a morning session where students are encouraged to participate in exams that assess university general-education goals and student satisfaction. The afternoon session is reserved for "departmental activities" (see: http://www.winona.edu/air/info/info.htm). Departments are encouraged to use this time to bring students together for program assessment activities; limited institutional funds to support departmental progress are available through a series of "challenge grants" (see http://www.winona.edu/air/Info/challenge08-09.htm).

The department felt strongly that we had to participate in some meaningful way so that we sent the message to students that "assessment matters." Our preference was to develop an assessment that measured our students' abilities to approach and resolve a field-based problem. Unfortunately, February in Minnesota is a challenging time for fieldwork, which forced us to look to alternative assessments. After much debate, we settled upon developing an "assessment exam," which would be administered to students each year on Assessment Day and would be designed to measure student's progress by assessing the depth and maturity of their responses. The central idea was to develop questions that student's who completed or were enrolled in our introductory sequence (physical geology and historical geology) could demonstrate what they learned in terms of simple rock identification or map and cross section interpretation, while we anticipated that upper-level students could synthesize content from multiple courses to provide much deeper and richer analysis in their responses. We made every effort to develop an exam that would challenge, but not demoralize, our students. This, in itself, turned out to be more difficult that we originally anticipated, given the disparity in knowledge and ability between a new entering student and a student in his/her last semester.

After spending about a year developing the exam, we administered it for three consecutive years on Assessment Day (2005-2007). We made small revisions to the exam each year as we saw how things went; revisions were generally minor, and made for clarification or to reduce the length of the exam. We coded the exams so that graders had no knowledge of student identity. Grading the exam presented an entire new set of challenges, as it was difficult to set aside a large enough block of time following the Assessment Day to work collaboratively to ensure internal consistency. Somewhat surprisingly, students were anxious to know how they did.

Our analysis of student performance showed that our initial hypotheses held true: students who had taken more geoscience courses performed better on the exam. However, we found that student performance at the upper level was not as strong as we anticipated it would be. When we interviewed students (graduates) to understand why, we learned that senior students didn't take the exam seriously. They completed it quickly and gave perfunctory answers, resulting in lower scores than expected. In short, our data analysis revealed that we needed to find ways to incorporate our assessment strategies into the fabric of our curriculum.

As a result of our experiences, we have since abandoned our departmental "assessment day" activities, and instead use that time for faculty planning toward on-going assessment. We have opted to move forward with two parallel strategies, both just in their infancy. We have agreed to create a set of exam questions that will be incorporated into the final exam of core courses, beginning with our introductory courses. Student responses to these questions will be tracked longitudinally to determine if we see improvements in the maturity of the response. Secondly, we have decided to implement a student-learning portfolio into our curriculum. We are piloting the portfolio project in two classes this spring semester (in Earth and Life through Time, the second course in the major sequence; and in Sedimentology and Stratigraphy, a junior-senior level writing intensive course).

Truth be told, this is a lot of work. It's difficult to hold the creative tension needed to work through the development process and not fall back on collecting numbers, whether these be grades earned in specific courses or numbers of students going on to graduate programs. It's challenging to think through developing exam questions that will elucidate connections through the curriculum and it's equally challenging to think through how to scaffold student development through portfolio creation and maintenance. Fortunately, our faculty are all committed to assessment as a means of both demonstrating our successes and improving upon our weaknesses. The process is fascinating and we're all learning a good deal. It's helped us, collectively, really come to true consensus on what we believe to be the most important aspects of our program and on our hopes and dreams for our graduates. Perhaps most significantly, our assessment process has affirmed that we agree on ~98% of what we do, making it much easier to resolve conflicts when and if they arise.

Stay tuned.

# Assessment in the Department of Geosciences, Boise State University

Since 2004, the Department of Geosciences at Boise State University has been assessing its undergraduate programs according to a formal plan that was developed after an on-campus workshop led by Dr. Barbara Walvoord. Development of the assessment plan began with the definition of learning goals for each of our undergraduate programs (geolosciences, geophysics, earth science education). Once the learning goals were defined, we defined assessment measures to address each goal.

The learning goals for each degree were defined in general terms so that most of them are shared among programs (for example, graduates will have effective written and oral communication skills). This parallelism allowed us to develop assessment measures that could be used for all degree programs. We defined the following assessment measures: 1) Direct evaluation of student research and oral presentations in a capstone seminar course; 2) Indirect measure of students' perceived learning evaluated in a senior exit interview and survey; 3) Indirect measure of the value of specific courses in meeting the program learning goals through end of semester course evaluations; and 4) Indirect measure of student preparedness from an alumni survey.

In practice, the most useful assessment measure has been the senior exit interview, which we have conducted in a group setting. The exit interview is held each spring for students who plan to graduate in May, August, or December. Discussion is facilitated, but not directed, by the Education Programs Manager, a staff member and adjunct faculty who oversees undergraduate advising, assessment, curriculum development, and outreach. Topics covered in the focus group include the overall curriculum, program strengths and weaknesses, specific courses, facilities, faculty, advising, and any other topics brought up by the students. Suggestions made in the senior focus groups that we have incorporated into actual changes include placing greater emphasis on writing and on using quantitative skills, the development of a sophomore-level course in geophysics, and the development of a stronger undergraduate advising program. The group setting for the interview allows students' memories and ideas to be sparked by their peers' comments. Sensitive comments can be made privately or as part of the senior survey.

At Boise State, end-of-semester course evaluations are designed and administered by each department. A positive consequence of this system is that we can include questions in the evaluation survey that provide information about topics specific to our programs. For example, students are asked to evaluate how well a course has helped them meet each learning goal. A negative consequence of this system is that there is not a university or college supported database of survey responses, so paper responses need to be compiled by hand. We have

**debated using an online evaluation survey but fear students will be less likely to complete them when not asked to do so during class time. Currently, the course evaluations are most widely used by individual faculty to make sure their courses are meeting the learning goals they expect.**

**We are currently struggling with the development of rubrics to evaluate student research in the capstone seminar course, and the measurement of overall student content knowledge. We are considering having students develop portfolios of their work as a proxy for measuring content knowledge. These portfolios would be evaluated during the senior capstone seminar, but again, we would need to develop a rubric for their evaluation. We have not yet administered an alumni survey.**

**Assessment Document: how we assess our students, our curriculum, and ourselves.**
**Bryn Mawr College – Department of Geology**
**Chairman – Arlo Weil**

***Pedagogical and Department Curriculum Assessment***

The geology faculty at Bryn Mawr spends a lot of time as individuals and as a group assessing the ways in which we teach our courses (to both majors and non-majors), as well as the ways in which we develop and modify our overall curricular offerings. The present makeup of the department faculty is young (soon to be three assistant-level, and two associate-level professors) – and as a result we have made a concerted effort to develop a unifying philosophy about our curriculum that is new, exciting to our students, and importantly, pliable. This movement towards community consensus started about six years ago after an intensive external departmental review. This review was extremely helpful in providing our junior faculty at the time (including myself) a framework by which to think about and change the "established classic" curriculum. Many of the suggested changes were seriously debated in faculty meetings over the following year – and subsequently, many of the ideas were incorporated into the curriculum we presently provide (e.g., moving from a two semester mineralogy, optics requirement – to a single semester of mineralogy and a second semester of modern petrotectonics). We strongly believe that these changes in curriculum, both at the major level and at the general education level have had a significant impact on our major numbers (up to an average of 12-15 graduating students a year from an average of 3-6).

Our department has also established – at the request of the current Provost – a long-term plan, which includes a working *Mission Statement* and a working list of goals. This document was conceived by the chair, but was thoroughly discussed, debated and modified by the entire department. Below is our *Mission Statement*:

The demand for highly qualified Earth scientists is growing nationally and internationally. Increasingly, society demands that the scientific establishment work to solve critical social issues, many of which focus on sustainability. By virtue of the history of our modes of integrative inquiry involving complex systems, operating on varied temporal and spatial scales, and handling incomplete data, geoscientists are uniquely qualified to fill a central role in addressing many present and future problems confronting humanity. With the ever widening demand for natural resources, the realities of global warming and the constant threat of natural disasters, students with expertise in Earth systems have the opportunity to contribute to the global community at many different levels. The mission of the Geology department at Bryn Mawr College is to develop, apply and convey scientific knowledge about the Earth and its systems today, in the future and throughout its 4.6 billion year history. This mission includes:

- Providing a high-quality undergraduate education that is transdisciplinary, problem- and process- oriented, and quantitative;
- Developing highly competent geoscience students prepared to analyze and comprehend the linkages among Earth system components and their physical and social context;

- Educating Bryn Mawr's general student population about Earth's natural systems, its resources, the role of humans as part of these systems, and our responsibility as planetary stewards;
- Developing and communicating new knowledge to the broader geoscience community through fundamental research that stems from application of emergent technologies;
- Applying geoscience knowledge to address problems affecting human society locally and globally, including effective stewardship of the natural world;
- Providing relevant geoscience information within the College community and beyond;
- Maintaining a faculty comprised of individuals with expertise in specific disciplinary areas of geology;
- Encouraging and support collaboration within and beyond the department among colleagues that share similar or complementary scholarship and teaching goals;
- Maintaining an environment within the Geology Department characterized by mutual respect, support and kindness among students, staff and faculty members.

The department has also begun on an annual end of summer two-day retreat, which is intended as a forum for discussing an array of topics that include, but are not limited to:

1. A re-examination and reevaluation of the department *Mission Statement*
2. The department as a community
3. Our future vision and place in the college
4. Our curriculum
5. The "Geology Major Experience" at Bryn Mawr College
6. Budget & endowed funds
7. Research
8. Concerns, desires, goals, wish lists

The purpose of these retreats is to provide a venue for faculty to flesh-out ideas, build consensus, develop solutions, and foster collegiality. Discussions are not intended to seem like a typical faculty meeting where information is conveyed and there is little discussion. The purpose is more to tap the collective insight, creativity, and energy of the faculty as colleagues.

These retreats have been very insightful and have helped to develop collegiality as well as consensus on what it is the department is trying to teach our students, and importantly how we determine that what we are doing, and what we are providing, is successful.

One of our ongoing projects that stemmed from a recent retreat is the creation of a working document of 'unifying Earth science concepts' that we feel are vital that every student understand before they leave Bryn Mawr with a degree in Geology. At the moment this is a work in progress, but we hope to have such a document in circulation by the beginning of the next academic year.

Another important goal of our faculty is to acquire, and update, the skills and expertise in pedagogy required to be a successful educator. Whenever possible our faculty have tried to participate in external pedagogical workshops – including several that have been sponsored by SERC (e.g., teaching structural geology in the 21st century) and several that have been established as part of the Bi-College community for younger faculty.

This past year (2007-2008) one of our faculty members pursued his interest in pedagogy and interdisciplinary work outside of the sciences by participating in a semester-long junior faculty pedagogy workshop supported by Bryn Mawr's Teaching and Learning Initiative (TLI). Together with colleagues in Cities, English, and History, there were weekly meetings established during the Fall 2007 semester to address the goals, needs, and worries of junior faculty. Additionally, the faulty attended each other's courses and provided classroom critiques. During that semester, new pedagogical methods were learned and old ones improved without the added stress or judgment of senior colleagues. In the Spring of 2008, a 45-page document was drafted based on observations and experiences, which will be the basis for future publication, and which was shared amongst the faculty in the Geology department.

***Course Assessment***

**Introductory level courses** at Bryn Mawr are filled with large numbers of students (typically about 50), a great majority of who are trying to meet laboratory/science requirements. These courses also happen to be the department's bread-and-butter in terms of Geology major recruitment. Our main form of assessment in these classes is the use of written evaluations – a practice the Geology department started decades before the institution required course evaluations. Several of these classes continue to use more detailed questionnaires than the generic College evaluation. Importantly, these supplementary assessment documents are quantifiable and can be tracked over time. As a department we are leaning more heavily towards instituting these types of questionnaires into all of our intro and general education classes – including documents for individual laboratory experiences to assess whether students 'get' the main intended points of a given exercise, and equally important if the enjoyed the experience and found it informative.

The historical record of these documents has taught us that:

1. Adopting the latest textbook should be an option—we should not rely so heavily on a text that the students couldn't take the course without it. Differences between editions are usually trivial—often even the page numbers are the same! Consequently, in some of these classes we have made a text optional, which has never resulted in a single complaint.
2. Students appreciate being given original readings—like selections from Darwin, Wallace, etc. (ones that they can understand), or articles from the primary literature (Science, Nature, Journal of….) rather than a text book summary of someone else's' work accompanied by a photograph of the author.

3. It is clear that students want to learn from the instructor, not from a textbook that we interpret or explain to them—the use of relevant anecdotes, examples, humor, etc. from our own experiences mean a lot more to them than textbook insets, web-based cartoons, videos, etc.

An important component of all of our introductory courses is the introduction of students to Geology through field trips. Here, evaluations have played a very influential role in determining the nature of field trips and there practices. An example being - our annual 100-level 3-day trip was cut to two tightly packed days that are focused on individual courses. At the same time, although some students complained about the time away from campus, the introductory field trips always receive high ratings on our evaluations (typically >4.0/5.0), and more often than not are regarded as the best part of the course, and led to many major declarations.

**Intermediate and advanced level courses** in Geology at Bryn Mawr generally involve between 8 and 15 students (often ~10) and evaluations are not a numerically rigorous way of getting assessment, unless there are clear trend. (An exception is our larger 200-level course like Evolution 236 [limited enrollment ~43] and Natural Hazards [often ~50 students], where evaluations early on revealed that a team taught approach, with two faculty present at every class meeting provides continuity, supplemented by visiting specialists, was very much appreciated by the students.)

From 200-level evaluations, we have learned that having students give evaluated oral presentations is much appreciated. Some students looked shocked when told they were going to have to make an oral presentation (and some avoided the task by missing class on the day they were due), but many others asked for more such opportunities. It is clear that our emphasis on oral presentations at the 200-level has made our oral senior thesis presentations much better over the past several years.

Some of our core 200-level courses require a semester-long research project (e.g., Palobiology 203 and Structural Geology 204), which involve a field trip to secure research material. The field trips are a strong bonding experience for students (many of whom did not know each other) and for the faculty/students—(Virtually all geol alums still reminisce about Geology field trips!). Instead of just grading these research papers, we try to give as much feedback to the students as possible, by editing them, returning them for revision, and requiring vigorous journal-level standards for rewriting of a technical, scientific paper. Feedback from evaluations and from discussions with alums indicates that this has been one of the longest-lasting experiences from some of our courses.

We also use oral examinations as a way of assessing student understanding – similar to oral examination assessment in graduate school. These exams allow our faculty to test the student's ability for critical thinking, as well as provide a means of evaluating how affective we are at conveying the important points in a course to the students. This is vital, because our core courses are all gateway experiences for the geology major and we

want to ensure that they will succeed in their future courses that are built on a foundation of mineralogy, sedimentology, paleontology, and structural geology.

Assessment in 300-level courses is more difficult, and probably can only be accurately obtained from alums. Popularity of a course does not mean rigor, and difficulty is often inversely proportional to popularity. Retrospective assessment from alums, once they have been exposed to graduate school or professions, has been very influential in guiding our course revisions. If there is a central theme it is --- require *more* writing, oral presentations, and independent research.

**The senior research thesis** in Geology has always been the capstone experience for our majors. It requires a one- or two semester research project developed with a formal thesis proposal, an oral presentation before the entire department, and it is read not only by the advisor, but by the entire faculty, and a grade is determined by faculty consensus.

In preparation we mentor students on projects that interest them, and discuss with majors what subjects they may wish to study in advance of their senior year. They are assisted during the year by participating in a senior thesis writing seminar, where they discuss ideas with their peers and faculty.

Assessment of this experience is almost exclusively by alum feedback. Consistently, over the past four decades, alums have regarded the senior thesis experience as the most worthwhile experience of their Geology major at Bryn Mawr. That said, the recent trend toward increased numbers of majors and options (not only Geology, but also Environmental Studies and Geoarchaeology) are making this labor-intensive experience difficult to continue at the same level. Modification of our senior thesis program is in order, and the department is actively and creatively re-imaging the senior experience so as to benefit everyone involved – both students and faculty. With increasing numbers of geology majors, this type of senior experience is not feasible due to:

a) Faculty time/projects to sustain this experience for all students
b) Money associated with each research project
c) Set system for evaluation for fair and balanced evaluation of all students

**Assessment in the Department of Geography, Geology, and the Environment, Slippery Rock University**

The Department of Geography, Geology, and the Environment was created in 2001 by the merger of the Department of Environmental Geoscience (EGEO) with the Department of Geography and Environmental Studies (G&ES). The G&ES program had a long tradition of assessment, primarily by means of exit interviews, but the EGEO program had no such tradition. Thus, departmental assessment activities were initially limited to the geography programs, due in large part to a lack of interest on the part of EGEO faculty. Motivated by administration requests for greater EGEO participation, and by departmental concerns about perceived and actual academic discontinuities within the various programs, it was decided to rework the entire departmental assessment process from the ground up. To this end, the department drafted a new set of outcomes that would "bridge the gap" between the social and natural science programs in the department. In addition, responsibility for departmental assessment was transferred from the department chair to a departmental assessment coordinator.

As I was beginning my responsibilities as departmental assessment coordinator, I attended a workshop given by Dr. Dan Weinstein of Winthrop University. One of the themes of the workshop was degree coherence, or the expansion of program assessment to include not only those courses offered in the home department, but also required courses in General Education (Liberal Studies) and support courses in math and the sciences. The motivation was to be able to demonstrate to external constituencies (such as university administration or accreditation agencies) that the program is not only successful in teaching its own core, but that it has designed

a coherent program that is providing a broad education that meets the mission of the university as a whole. University outcomes generally include concepts, skills, or capabilities beyond the specialty of the department, so how can we demonstrate that our major programs are accomplishing the university mission? As an example, one of SRU's university-wide student learning outcomes is aesthetic appreciation. This is not typically addressed in a traditional geology curriculum, but is a significant part of the Liberal Studies program. Thus, although we (as geology faculty) don't directly teach courses in aesthetic appreciation, all of our students are exposed to this important field through the Liberal Studies requirement for their degree. This process of examining program coherence is formalized in our assessment plan, and is reported to the administration through a degree coherence matrix that has been incorporated throughout the university.

Currently, we are at the stage of seriously examining all of our programs in light of the new set of learning outcomes that were developed and implemented over the last three years. In particular, we are examining the coherence of our programs, both in terms of how the course requirements meet program outcomes, and in terms of how our programs fit within the broader mission of the university. Major problems at this point are still structural: identifying changes in the curriculum that would improve the program without unduly impacting student learning (which is definitely aided by continuity and can be negatively influenced by radical, rapid changes.) Positive results have included a greater sense of unity in the department through the recognition that many of our expectations for student learning are the same, regardless of the specific major program, and the opportunity this process has provided for updating and revising programs that have remained static for several decades.