

## TEACHING PORTFOLIO

R. Heather Macdonald  
Department of Geology  
College of William and Mary  
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### Teaching Responsibilities

My teaching responsibilities in the Department of Geology include teaching undergraduate courses, advising students, and encouraging their professional development. I teach the sequence of introductory courses *Physical Geology* and *Historical Geology*. *Physical Geology* is a large lecture-based course (~100 students); some students in the course are planning to major in geology or environmental science, some are taking the course to satisfy their natural science requirement, and some are terrified of taking a science course. *Historical Geology*, in which I teach the lecture and all the laboratory sections, is taken by students choosing to take a second geology course (~50–70 students). I also regularly teach *Sedimentology and Stratigraphy*, a junior-level course (lecture and lab) required for geology majors but also taken by other students including anthropology majors and geology minors. In the past few years this has enrolled ~20–30 students. In alternate years I teach *Marine Geology*, a large lecture course (~60–100 students) that includes senior geology majors as well as first-year students who have taken *Physical Geology* the previous semester. I have taught *Introduction to Geologic Research*, a required junior-level course that prepares geology majors for their independent senior research project. I also supervise students working on these required projects and advise geology majors on course selection, summer opportunities, post-baccalaureate plans, and overall professional development. During the three years I have been Dean of Undergraduate Studies, Arts and Sciences, my involvement in teaching in the Department of Geology has been limited. In this portfolio, I

focus on introductory courses, student career development, and teaching development activities.

### Teaching Goals and Methods

In my classes, I want students to be actively involved and to develop as independent learners. In general, they should have the experience of “doing” geology—at whatever the level of the course. I want them to learn the material covered in the course to better understand the Earth—its materials and the internal and external processes that are acting on it—and, more importantly, to understand the approach geologists take to asking and answering questions about the Earth. One of my goals is that students, especially those who are intimidated by natural science, will learn a different way to study the natural world and gain confidence in their ability to understand one of the natural sciences. I also want to develop students’ oral and written communication skills. In my contacts with students, both in and out of courses, I want to help them develop professionally by providing them with information, opportunities, and encouragement. Finally, the atmosphere in which teaching and learning takes place is important to me, and being enthusiastic about what I do and teach, having an interest in the students, and trying to be open and fair helps to establish an environment in which all students are encouraged and challenged.

In my introductory classes, I still teach primarily by lecturing, although I use a variety of other approaches to encourage student learning. I show slides almost every class, and videos on occasion, because it helps students to see examples of geologic features and processes. I commonly use various informal cooperative learning activities and classroom assessment techniques (CATs) to engage the students in processing the material. In one cooperative learning activity (Think-Pair-Share), I pose a question or problem, ask each student to write out a response, and then have the students discuss their response with another student. I then call on a few students to answer, ensuring some accountability, getting different perspectives, and bringing the short discussion to closure. This gives each student time to compose an answer and to discuss the answer with another student. In one CAT (the one-minute paper), students write about the most important point of a lecture or ask a question left unanswered by the lecture at the end of the class period. Reading the ungraded papers takes relatively little time, but provides valuable feedback on student understanding.

I have increasingly supplemented lectures with a variety of writing assignments, oral presentations, and group assignments to increase the active involvement of students in learning. Writing assignments are important because, through the process of writing, students can both develop their writing skills and learn geology. Although I hated talking in class when I was a student, I think my students should be talking about geoscience—to me, to each other, and to the

class. As teachers, we should promote conversations among students about the subjects we teach. Giving group assignments and structuring those assignments to promote effective group work provides an opportunity for students to learn from each other. It is also good experience because many positions today, including those in the sciences, involve people working together. Collectively, these types of assignments promote students working together as colleagues.

A National Science Foundation grant has supported my efforts to incorporate small group learning experiences in large lecture classes. Faculty from across campus (Writing Program and School of Education) have helped me develop a series of cooperative learning assignments involving a final written or oral product. Small groups of ten to fourteen students meet together nine to ten times a semester during the lecture period. An undergraduate teaching assistant who has been through a training program monitors each group and provides feedback on writing assignments and group activities.

In many respects, what I am trying to do in large lecture courses happens more naturally in the laboratory and field. *Historical Geology* labs may start with a short lecture, but most of the period consists of students working together on an assignment as I move around the room asking questions, then discussing the results as a group at various points during the lab period. I encourage students to work with each other, and some of the assignments involve peer teaching. In the field, students are confronted with a problem that is not artificially constructed. I ask questions—What do you see? What does it mean? What is an alternative explanation? How could you determine which is a better explanation? Students are working together as peers as they discuss the geology.

I try to establish a supportive atmosphere in which students work comfortably with each other and me and have both fun and serious discussion. I encourage students to get to know each other, commonly using icebreaker activities. To help students achieve, I set clear expectations, comment on student papers, and note improvements and/or make suggestions on papers and exams. In addition to office hours, I offer study groups and encourage all students, especially those who receive D's or F's on exams, to participate.

Career development of geology majors is an important component of my teaching. I give students information about careers in the geosciences and about how a background in geology can be used in other careers. Students can learn more about what geoscientists do when guest lecturers talk about their job/career as well as their area of expertise. I also encourage students to participate in activities outside the classroom, such as volunteer programs in local schools, externships, and summer research internships at other institutions.

#### Course Syllabi and Assignments

Copies of the most recent syllabi from my introductory courses are in Appendix A. The syllabi list the day-by-day topics and reading assignments, give the

objectives of the course, and describe the various ways students participate in the course and how they will be evaluated. Writing assignments and formal group work are two components unusual in a large introductory geology course. Students in each course write two or three short (one or two page) papers; they also participate in peer review groups or other group work that results in some type of oral presentation.

Copies of writing assignments are included in Appendix B. Many of these involve reading outside the textbook, either from the primary geological literature or the popular science literature (e.g., essays in John McPhee's *Control of Nature*). In one assignment for *Physical Geology*, students describe one (of several) rocks, then read another student's rock description and see if they can identify the rock described by the student. In another assignment, students write about garbage and the waste disposal problem, water supply issues, or a geoscientist's job and career. For each choice, students get information from a source other than the textbook. For the first two choices, they read articles on reserve in the library, then write a letter to an elected official or an editorial. For the third, they contact a geologist from a list I provide, conduct an informational interview, and write a career profile of the geoscientist.

Assignments from *Historical Geology*, also included in Appendix B, demonstrate the ways I have incorporated formal group work involving individual writing assignments and group oral presentations. One assignment involves the students in an ongoing geological controversy: The cause of the mass extinctions (including dinosaurs) at the end of the Mesozoic Era. After reading a summary article of various explanations of the extinctions, each student reads an article from the primary literature. After the students work in groups to build an argument for or against a particular explanation, the class debates the cause of the extinctions.

The response paper assignment in *Historical Geology* is an unusual approach to talks given by visiting speakers. Rather than requiring students to write a summary of the talk, I have them write about what they found most interesting and submit one question they had about the talk. This promotes careful and critical listening and encourages a questioning approach.

An example of a lab exercise that involves peer teaching is an introduction to the major groups of fossils. I want the students to learn the characteristics of several groups, and provide materials (handouts, books, fossils and modern examples, and a set of questions) for each group. I arrange the students into small groups where they learn about their assigned group of fossils, answer the questions given, and then teach the rest of the class about the characteristic features of that group.

#### Student Career Development Activities

I provide students with information on careers through a variety of mechanisms such as discussing careers in class, requiring attendance at visiting speaker pro-

grams, and encouraging students to read the departmental newsletter, which gives information on alumni and their jobs. Through assignments in my courses, students develop writing skills, oral communication skills, and critical thinking skills as well as a good geological background; such skills are considered important by both employers and graduate schools. Students can participate in a variety of experiences that develop skills and expertise, such as being a teaching assistant in geology courses, attending professional meetings, participating in summer internship programs, doing a senior research project, and working with local elementary school classes. I encourage students in their career development by suggesting that they take advantage of such opportunities, offering graduate school advising sessions, reviewing resumes, and nominating them for various awards.

### Evaluation of Teaching Effectiveness

The summarized numerical components of my student evaluations are given in Appendix C. The quality of teaching in the geology department is consistently and uniformly high. On a scale of 1 to 5 (where 5 is excellent), the departmental average has been between 4.4 and 4.5 in a recent two-year period. The overall averages for several of my courses are given below.

Course	Term	Overall Average
GEO 102	spring 1993	4.60
GEO 101	fall 1993	4.57
GEO 101	fall 1992	4.55
GEO 101	fall 1991	4.69

One of the evaluation items that is directly related to my teaching goals and is important to me is "The instructor shows enthusiasm for the subject matter." My score on this item is consistently high, and in the Fall 1992 semester was 4.90. I would like to have a similar score for questions related to the level of the course (i.e., more or less challenging). I have attempted to evaluate my teaching methods through student evaluations of specific assignments—both an overall rating and a rating of various components of each assignment. These are discussed in more detail in the section on *Teaching Development Activities*.

I have selected three quotes from student evaluations that describe what happens in my classes from their perspective. I am pleased that they recognize my enthusiasm and appreciate the value of the various teaching methods I employ, and more importantly, that they think that have learned in the process of taking my course.

- "Enthusiasm. That's what defines the shape of this course: even those who don't care much for geology can't seem to help enjoying themselves and learning in the process."

- "Dr. Macdonald is an excellent instructor who really seems to care; e.g., we discussed *strategies* for studying after I did poorly on my first exam instead of her telling me to put in more time."
- "I felt the group projects were valuable—for our knowledge of geology, a new way to learn, and for our interactions in a group setting."

Letters from students and former students included in Appendix D give their view of my teaching. The first African American geology major at the college wrote to thank me for my support and encouragement over the years. One former student commented that I am "one of those unusual teachers who manages to combine a comprehensive and challenging class with one that is both interesting and fun. Her students are easily involved through her hands-on teaching style and genuine concern and interest for their needs." And that is what I try to do—both encourage and challenge students.

I have collected a variety of information about changes that take place in my courses. For example, in *Historical Geology*, students completed a questionnaire to measure their confidence in discussing various scientific topics. On a four-point scale, their confidence in discussing topics covered in the course increased from 1 to 1 1/2 points by the end of the course, and their confidence in topics covered in *Physical Geology* increased somewhat. Students also completed a survey at the beginning and end of the course in which they rated their ability to write and to work effectively in groups. These ratings increased slightly over the semester. Appendix E includes successive drafts of papers written for both introductory courses and short essays students wrote on similar topics at the beginning and end of the semester in the courses that involved formal group assignments.

### Student Accomplishments

Many geology majors, with my support, have received summer research internships. In a recent year these included internships at the University of Tennessee, the University of Delaware, Woods Hole Oceanographic Institution, the School of Marine Science at the College of William and Mary, and a Keck Geology Consortium project for minority students. Three students who assumed leadership roles in a partnering program with local elementary schools have presented a poster session at the Southeastern Section Geological Society of America meeting.

I am pleased with the recognition my students have received. For example, in a recent five-year period, three of my students received the Penelope Hanshaw Award given to an outstanding woman geoscience student by the Association for Women Geoscientists (Potomac Chapter) on the basis of academic excellence and their contributions to the goals of AWG. I am also pleased that one student received the Bill Greenwood Award (outstanding minority geoscience student), also given by AWG-Potomac Chapter.

### Honors Related to Teaching

I am one of several geoscientists in the 1995/96 National Association of Geoscience Teachers (NAGT) Distinguished Speaker Program and am also President of the NAGT. I am fortunate to have received several teaching awards. At the College of William and Mary, I received the Thomas Jefferson Teaching Award in 1990, given annually to a faculty member early in his/her career. In 1992, I received the first Biggs Earth Science Teaching Award. This award is given by the Geological Society of America (GSA) to a faculty member in his/her first ten years of teaching in recognition of his/her contributions to geoscience education. Bruce Goodwin, my department chair, submitted a nomination packet including letters from students, former students, and colleagues. A committee of the Education Division of GSA made the selection.

### Teaching Development Activities

Feedback from students is an important source of information that I use to evaluate and improve my courses. For example, I have data from the four major group assignments in *Historical Geology*. Students rated each assignment overall and also rated various components of the assignments. The extinction assignments described earlier received the highest rating, consistent with my evaluation. I will modify the organic evolution assignment, which received the lowest rating, the next time I teach the class. A summary of the ratings is given in Appendix F. Whenever I try something different in class, I have students complete a questionnaire. I then use the results to modify the assignment. I try to determine what components of the assignments work, then try to repeat those in other assignments.

I also try to improve my teaching by reading, attending conferences, and participating in workshops. I get ideas about specific approaches and assignments from the *Journal of Geoscience Education*, the *Journal of College Science Teaching*, and various educational publications. I try to incorporate topics from material I read in the geologic literature into my courses. For example, I am continually adding articles on the extinction controversy to my collection, which I make available to students preparing for that assignment. One of the most important workshops in terms of its effect on my teaching was the workshop on *Teaching with Writing* that I co-directed with Colleen Kennedy, Director of the Writing Program at William and Mary. I learned about other teaching approaches and techniques as well as how to better incorporate writing assignments and peer review sessions into my own courses. I developed critique sheets to focus student attention on certain aspects of each paper they were reviewing. Another influential experience was the *What Works* Conference on Building Effective Collaborative Learning Experiences held in 1994. The workshop by Barbara Millis provided me with an excellent overview of collaborative learning and specific cooperative-learning structures. I was first introduced to teaching

portfolios and their value in a workshop given by Peter Seldin (Pace University) and Linda Annis (Ball State University).

In my position as Dean of Undergraduate Studies, I have worked to promote discussions about teaching at the College of William and Mary. I have invited guest speakers to give talks and workshops and have arranged for faculty members at the College of William and Mary to give workshops to their colleagues on campus. With other colleagues, I have organized teaching enhancement projects in which faculty in a variety of disciplines examine successful teaching techniques, explore ways to enhance their teaching, and develop a course portfolio (a teaching portfolio for a specific course).

### Dissemination of Teaching Experiences

I have given talks and workshops on various aspects of teaching at several institutions including the University of Kansas, Emporia State University, Murray State University, the University of Wisconsin—Eau Claire, the University of Maryland, and the United Arab Emirates University. I was invited to speak at the symposium “Innovative Approaches to Teaching Introductory Geology” at the annual Geological Society of America (GSA) meeting in 1990. I was also invited to give a talk in the session “Great Ideas from Great Teachers” at the 1995 southeastern section GSA meeting. With other colleagues, I have organized workshops on effective and innovative geoscience teaching at GSA meetings.

I have also written articles about various geoscience education topics (Appendix G). Examples of three of my recent presentations include *More Than Lectures: Alternative Teaching Strategies in Introductory Geology Courses*; *Developing Student Career Choices*; and *Teaching Portfolios to Document and Improve Teaching in the Geosciences*. I have also organized two theme sessions at Geological Society of America meetings—one on using writing assignments to teach geology and another on using group work in geoscience courses—and one symposium on assessing teaching and learning. The papers from the writing and group work sessions have been published in the *Journal of Geoscience Education*.

I value collaboration and have benefitted greatly by working with several geoscience colleagues. In particular, I worked with Susan Conrad (Duchess Community College) and Ann Bykerk-Kauffman (California State University—Chico) in organizing the writing and groups sessions, respectively, and in editing with me the resulting papers. Barbara Tewksbury (Hamilton College) and I have worked together on various projects designed to promote geoscience education, including the NAGT Distinguished Speaker Program and workshops on effective and innovative teaching given at professional geoscience meetings.

### Future Plans

I am choosing to return to the teaching faculty and have several goals for the future. In all of the courses I teach, I want to move away from lectures and will

design activities that are more challenging and involve the students more in doing what geologists actually do (rather than listening to me lecture). I also want to participate in peer evaluations of teaching. Although I have received recognition for the quality of my teaching, none of my colleagues has seen me teach in the classroom. I think this will be a challenging experience, but one that will be very beneficial to me. I also plan to continue to work with colleagues to promote innovative and effective teaching in the geosciences.

**Appendices**

Appendix A: Course Syllabi

Appendix B: Sample Assignments

Appendix C: Student Evaluations

Appendix D: Letters From Students and Former Students

Appendix E: Successive Drafts and Graded Student Papers

Appendix F: Student Ratings of Assignments

Appendix G: Publications on Geoscience Education

