

Teaching Portfolio

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Statement of Teaching Philosophy

As a student, I have observed that the best teachers were those who cared the most about teaching. This passion is one of the single most important components of effective teaching as it leads to thorough preparation, continuous evolution of teaching skills, and the pleasure of watching students learn. The amount of time that a teacher puts into preparation directly translates to how the students learn. However, a teacher must be able to recognize how students learn best at the group and individual level, and let their lesson plans metamorphose as they interact with their students. The ultimate goal for the teacher is to communicate new information to students, not just memorizing facts, but also to learn how to think. This process can be made more efficient when both the teacher and the students enjoy what they are covering. Combined, these aspects allow a teacher to determine how a certain group of students will learn best. In my teaching experience, efficient learning by students consists of the combination of formal lecture periods, and smaller discussion sections.

During lecture periods, students are exposed to a stream of organized information that will teach them the basic blocks of the subject. The impact on the student is enhanced when the lecture is given as a narrative; where the information is clear and organized but presented in a softer story-like manner rather than dry lecturing. This also allows the lecturer not just to present coherent information, but also to keep a captive audience. In physical sciences, and in particular within earth sciences, teachers often ask students to take a leap of faith when learning new material. Concepts that are the fundamental building blocks of subject and sometimes abstract, are often taught in reduced form in order to quickly lead the students to see the big picture, particularly at the introductory level. For example, when teaching an introductory course in earth sciences, the lecturer must explain how atoms are the building blocks of molecules, which link to form minerals, and these minerals combine to form rocks. The audience is not necessarily familiar with the fundamental chemistry in order to understand the subject at every facet, however the goal for the teacher is get the student to understand the larger driving forces behind how and where these rocks and minerals form, and not advanced chemistry. The students are asked to take a leap of faith; they have to trust the lecturer enough to accept these possibly unfamiliar ideas in order to move on to see the larger framework. Trust in the teacher is also derived from the passion to teach. When students see that their teacher has a passion for

teaching and for the subject, they have an easier time accepting that the difficult material because they trust the teacher. For a teacher to say “this is complex, but we will return to it after trying to see the bigger picture”, requires trust by the students so that they don’t just doze off. Teachers who lack the passion to teach run the risk of losing this trust in students, who might easily just tune out the subject, rather than try to understand a perplexing concept. The lecturer is responsible for reviewing this more difficult material in a discussion section where the subject can be treated with greater detail, allowing the students more time to integrate all parts of a subject to see the big picture.

In discussion sections, students working in smaller groups explore subjects at a deeper level than presented during lectures. In this open atmosphere, the discussion can progress on tangents instead as a linear narrative, allowing students to work on a specific subtopic before moving on to the next concept of the general subject. The teacher acts as to facilitate the discussion using a Socratic type method to guide the conversation. While students are not always happy to ask a question, and get a one in response, this method is ultimately very fulfilling for them. In my experience, if students are simply given an answer, they are not forced to go through any thought processes to figure out the problem. However, when asking them questions in response to theirs, they can be lead along a line of thought where they work through the answer themselves, with some assistance in trajectory. Students feel satisfaction for working through the problem, and for effectively teaching themselves the answer. By not spoon-feeding them responses, they develop the tools to work through a general problem, and not simply how to memorize answers. They now learn how to adapt to different systems, where the synthesis tools are the same. At introductory levels, discussion sections are often stagnant because of student’s timidity toward giving responses. In order to stimulate conversations, the discussion leader has to rely on icebreaker skills to motivate students to talk. The simple act of learning a student’s name and a piece of information about them shows the students that the teacher has a vested interest in their class, and is genuinely interested in helping their students. Calling a student by name makes for a more intimate relationship between teacher and student, and again allows the students to put trust in the discussion leader. The teacher is then free to ask questions in order to lead a discussion, without getting blank stares in return. In more advanced classes, a discussion leader might simply be able to pose a few questions, and only intermittently add

insight to facilitate discussion. This can be one of the more pleasurable teaching experiences, as the teacher can now watch as the students learn and teach with each other based on the knowledge set that they have been given by the teacher.

Some of my favorite teaching experiences have been when I have been able to integrate both lecturing and discussion components into a single setting. This can frequently occur in the form of review sessions. I have been a teaching assistant for the course “Earth Materials” (a core sophomore level class in the department of Geological and Environmental Sciences) several times. For the final exam, I have developed two review sessions in order to help the students assess the large amount covered in this course. For each session, I have developed a question and answer packet that the students work through during the session. My goal for them is to help them organize the information they have been taught, and to make sure they understand the material at a detail level, but also to understand how each part fits into the whole and to see the big picture. During the review sessions, I have the students work together to answer the questions. When new questions arise, I instruct them to ask each other so that everyone is part of the learning process. When they reach a question they can’t answer, it is now my task to do some lecturing, and help them sift through the material. I can review tricky material, or present a clearer picture than what was presented during the initial lecture. It is also in this forum that students can clearly see how I have a passion to teach. When helping students through a tricky problem, I enjoy watching the light flash in their eyes when they work a problem through to completion. My enthusiasm to teach translates to their enthusiasm to learn. This enthusiasm coupled with proper instruction allows the students not only to meet their educational goals, but also enjoy their time during the process.

Teaching and Mentoring Experience

The following brief descriptions detail my experience as a graduate student teaching assistant and freshman advisor at Stanford University.

GES-1 Fundamentals of Geology (Spring 2003)

This large introductory course is intended to give students from a variety of backgrounds a basic understanding of how the earth works, and what geologists study. As one of several TAs, my primary duty was teaching a laboratory section of 15 students that met once a week. During this section, I would give a 10 to 15 minute lecture at the beginning, which would cover the material relevant to the laboratory project including specific details, and how to relate the project to the material covered in lecture. Laboratory projects included using physical properties to identify approximately 15 minerals and 15 rock types. Laboratory projects also included hands-on demonstrations of physical geology and integrating geological information from several types of maps. Two laboratory sessions were field trips; to see evidence of San Andreas faulting, and stream processes near campus. One these trips, I led the students through a short project to understand the local geology, and assist them in integrating this into the larger scope of the class. I was responsible for grading the laboratory projects for my own section, as well as assisting the other TAs and Professor Mike McWilliams in grading the midterm and final. I also developed an extra credit project for the class for students to learn “suburban geology”. The students took a tour of the Stanford campus, to gain experience in describing and classifying rocks by observing samples in an admittedly unnatural geologic environment and to learn a little more about their own ‘backyard’; to become more aware of the interesting rock types often used as building stones in the urban and suburban environment.

GES-80 Earth Materials (Fall 2002; 2003; 2004)

This course is a combination of two previously offered classes, mineralogy and petrology, and is a sophomore level class within the core curriculum for GES undergrads. Because of the large amount of material covered, the TAs have a rigorous work load which presents ample teaching possibilities, more so than other classes in the department. During the three terms, I was the head TA and taught 15-20 students with three other TAs. Our primary responsibility was leading a weekly laboratory section that focused on using physical properties

to identify rocks and minerals. In this section, the students were also expected to consider where and how these materials formed using concepts developed during the lectures. During these sessions, the TAs would give a 15-minute lecture at the beginning, and then assist the students while working in smaller groups through the weekly project. The TAs also met with students outside of class on a weekly basis to revisit material and go into greater depth.

The TAs were responsible for grading 45% of the students total grade, including weekly laboratory projects, weekly quizzes, bi-weekly problem sets, laboratory final exam, and a report from a weekend field trip. Given the amount of contact that I had with the students during the laboratory sessions, I worked closely with Professors Gordon Brown and Juhn Liou in determining grades, as I could observe individual student's progress each week through the term. I developed the laboratory quizzes and final exam, with assistance from the to other TAs. I also developed an optical mineralogy supplement to be used during each laboratory session, intended to give a brief overview of how to use optical microscopes to assist in mineral identification, before being exposed to more advanced optical mineralogy skills in future classes. For both the final exam, I developed two review sessions intended to help the students organize the vast amount of material covered in during the class, and students gave very positive feedback in response to these two sessions.

During the Fall 2004 term, I was given the opportunity to give three lectures during the absence of Professor Brown, raising my status from Teaching Assistant to "Teaching Mentor Affiliate". The topics of these lectures ranged from introductory material to higher-level mineralogy, and I received positive feedback on both the content and style of the lectures from the students, fellow TAs, and Professor Liou.

GES-90 Introduction to Geochemistry (Winter 2003)

My primary role in this sophomore level class was to help students outside of class with questions regarding the lecture material and grading weekly homework sets. I worked closely with Professor Jonathan Stebbins in determining the strengths and weaknesses of the class of about 20 students, as well as contributing questions for the midterm and final. Students are required to take this course as part of the GES core and often take it subsequent to GES-1. The course requires an introductory level of chemistry, which not every student has yet and one of

the challenges of the class is using time outside of lecture to bring every student to the same level required in the class. I also led review sessions before the exams to make sure students were able to organize the material presented during lecture, and could integrate specific details using the general concepts they learned.

GES-170 Environmental Geochemistry (Winter 2004)

The aim of this course is to give students a review of geochemical concepts during the first half of the term, and then spend the remainder of the term discussing case studies. In this upper-level course, students come from a variety of backgrounds, including geology, civil engineering, and chemical engineering, and both undergraduate and graduate students. One of my roles was answering questions during office hours and at review sessions to make sure that the lecture material was accessible to all students. I worked with Professor Gordon Brown to develop a computer-based project intended to introduce students to a graphical thermodynamic modeling tool. After giving a demonstration, the students were then responsible for using the program for geochemical problem. I was also responsible for grading bi-weekly problem sets and assisting Professor Brown in grading the final oral presentation projects.

Freshman Academic Resources and Mentoring (Fall 2004/Winter 2005)

The Freshman Academic Resources and Mentoring (FARM) program is part of Stanford University's Expanded Advising Program (EAP). The purpose of FARM is to introduce students with similar academic interests to academic resources and small-group mentoring, investigate research and grant projects outside the classroom, and to facilitate personal interaction with faculty, staff, and alumni. Each group of students (five in my group), are paired with an upper class undergraduate and graduate advisor. The role of the undergraduate advisor is to help the freshman become more oriented with the university, and teach them how to better integrate themselves into campus life. My role as the graduate student mentor is to give the freshman advice about what they should be aiming for over the course of their college career, and to even begin thinking about what they want after college. While many students find it strange to start considering life after graduation when they've just begun their first year, the thought processes alone are instructive for them to begin to plan their time at Stanford, and not simply to pass

through. Our group usually met over dinner, and worked through a curriculum planned by the FARM staff, although our conversations frequently strayed from the specified curriculum to topics that were more relevant. One of the biggest positives about the program was getting students to meet and talk to other freshman outside their normal peer groups. Students would frequently bring up questions and concerns with our group that they might feel uncomfortable talking to friends about. Another constructive part of the program is promoting students to interact more with graduate students and professors, and build lasting relationships with them. This enhances what they learn in classes, as they are simply not being fed information, but are taking an active part of their learning process.

GES-80 Teaching Assistant Evaluation

This is a summary of student responses from the TA evaluation suggested by the Center for Teaching and Learning at Stanford University. For this course, GES-80 "Earth Materials" (Fall 2004), the primary responsibilities as head-TA were leading a weekly laboratory section, and grading laboratory quizzes, laboratory projects, problem sets, and the field trip report. Additional tasks included the designing of review sessions, and giving three lectures.

Student Comments:

- David was great at answering questions clearly and concisely about the assignments and topics that had not been clear in lectures. He was a good resource.
- Always available for questions – during office hours, lab, email, etc. Very approachable and knowledgeable.
- Puts complicated ideas in terms I can understand.
- He did a good job of explaining the details so you understood the complexing [parts] of the situation and the range of possibilities.
- I can depend on him to have reliable answers that he can back with an explanation.
- He was very serious about his job and extremely knowledgeable; His lectures were more clear than those of the professors; He made sure that we understood the most important concepts first, but also that we didn't let less important concepts slip by.
- David was always ready to help and offered knowledgeable explanations that were often more understandable than the professors; David in particular expends a lot of effort in his preparation and organization of the class.
- I think you'll make a great professor.
- Possibly the best TA I've had.

Evaluation Responses (11 responses from a class of 15 students):

Rating scale from 1 (poor) to 5 (highest)

(1) Organization of the TAs lectures:	4.5
(2) Gave positive feedback:	4.5
(3) Improved comprehension of the material:	4.5
(4) Developed thinking skills:	4.1

GES-90 Teaching Assistant Evaluation

This is a summary of student responses from the TA evaluation provided by the Registrars office of Stanford University. For this course, GES-90 "Introduction to Geochemistry" (Winter 2003), the primary TA responsibility was helping students with problems sets, particularly during organized problem set review sessions.

Student Comments:

- David is one of the best TAs at Stanford; [he is] clear, precise, fair grader, and gets papers back quickly; always willing to help.
- He always answered question clearly and explained things well; David was always available and willing to help – it helped a lot to have that.
- The problem set sessions were great and very helpful.

Evaluation Responses (15 responses from a class of 20 students):

Rating scale from 1 (poor) to 5 (highest)

- | | |
|-------------------------------------|-----|
| (1) Was well prepared for section: | 4.6 |
| (2) Presented material clearly: | 4.5 |
| (3) Provided helpful feedback: | 4.6 |
| (4) Gave clear explanations: | 4.6 |
| (5) Was available outside of class: | 4.9 |
| (6) Overall teaching effectiveness: | 4.6 |

Potential Courses and Seminars

The following is a list and brief description of the courses and seminars I could teach.

I. Introduction to Geology

This course would cover the fundamental principles of geological sciences and is intended for students from a wide range of backgrounds. The class would include a laboratory sessions and field trips to make the lecture material both relevant and hands-on. Since the class is also intended to be a source of majors, it would give them the basic tools need to continue in geological sciences. Topics include:

- The origins of the universe and the Earth
- Chemistry and physical structure of the Earth, and the theory of Plate Tectonics
- Mineralogy and Geochemistry, and the Rock Cycle
- Igneous Petrology
- Metamorphic Petrology
- Volcanoes and Earthquakes
- Physical Geology
- Weathering, erosion, climate, and the water cycle
- Energy and mineral resources, Environmental geology

II. Mineralogy

This course is intended to be a sophomore-level core curriculum class taken at the beginning of a major in geological and environmental sciences. The class would have a significant laboratory portion and field trip to see minerals in their natural setting. The laboratory section would focus on learning how to identify minerals in hand-sample and in thin section, using a petrographic microscope. Lecture topics include:

- History of mineralogy
- Crystallography and symmetry
- Crystal chemistry and physics
- Physical Properties of minerals
- Mineralogical tools; X-ray diffraction, Scanning Electron Microscopes and Electron Microprobes.
- Optical Mineralogy
- Mineral Stability Diagrams
- Rock assemblages and Plate Tectonics – where do minerals form

III. Geochemistry

This course would also be a sophomore-level core curriculum class taken at the beginning of the major in order to establish a firm understanding of the fundamental of geochemistry, which are relevant throughout geological and environmental sciences. The course would also rely heavily on problem sets to give the students an opportunity to apply lecture material to real situations. Lecture topics include:

- Origin and abundance of the elements
- Chemical equilibrium and Thermodynamics
- Aqueous solution geochemistry
- Mineral equilibria
- Oxidation/reduction reactions
- Stable and radioactive isotopes
- Organic geochemistry
- Reaction Kinetics, rates, and mass transfer

IV. Mineral Chemistry and Physics

This course is intended as either an upper-level or graduate course to introduce students to the concepts and literature of mineral chemistry and physics, as well as the tools that earth scientists use for these subjects. The course would consist of lectures, laboratory demonstrations and problems sets, and a final project and paper where students actually get to use those tools to apply to a mineralogical problem. Topics include:

- Crystallography and symmetry – group theory, point groups, and space groups
- Crystal chemistry – atomic and molecular properties, Pauling's Rules, crystal field and molecular orbital theory
- Mineral surfaces
- Diffraction techniques – X-ray and neutrons
- Spectroscopic techniques – visible, X-ray absorption, IR, Raman, NMR, photoemission

V. Environmental Geochemistry and Mineralogy

This course would work best as an upper-level or graduate seminar, consisting of lectures and discussion sections. The lectures would review the fundamental concepts of geochemistry and mineralogy, and how to apply them to environmental problems. The discussion section would allow students to read recent literature and see how these problems are treated academically and industrially. For each discussion section, a small group of students would read a few peer-reviewed journal papers and present questions to the class to further probe the topic. Lecture and discussion topics include:

- Review of mineralogy and geochemistry fundamentals
- Global climate change and the atmosphere; the carbon cycle, greenhouse gasses, and the ozone layer
- Surface and Marine process; the water cycle, mineral weather, transport of metals
- Oxidation/reduction reactions in surface environments; the impact of microorganisms
- Mining and heavy metal contamination
- Radioactive waste generation and disposal
- Asbestos and mineral dust hazards

GES-80 Igneous and Metamorphic Petrology Mini-Reviews

The following two handouts were created in order to help organize the vast amount of material covered during GES-80, "Earth Materials". The review sessions were organized such that the students would work through the handout and consult with each other as a group when questions arose. The primary role of the TA was to keep discussion moving and answer difficult questions, as well as to review lecture material when required to fill in a void in the fundamental ideas.

		Igneous Petrology Mini-Review							
% SiO ₂	Ultramafic int. ext.	Mafic int. ext.	Felsic int. ext.	Tectonic Environment		Example Locations	Petrogenesis	Diagnostic Properties	
				name	minerals				

Igneous Petrology Mini-Review

Some questions to ponder...

- ❖ What are the three ways to form a partial melt by crossing the solidus (which cools to form an igneous rock)?
 - 1.
 - 2.
 - 3.

- ❖ What are the effects of adding water to a rock?
 - 1.
 - 2.
 - 3.
 - 4.
 - 5.

- ❖ How does water affect the slope of the solidus and what accounts for this change compared to the dry solidus?

- ❖ What causes the differences in shield volcanoes and pyroclastic volcanoes?

- ❖ Why is it significant that granites have two feldspars (i.e. what element specifically makes these feldspars different from a feldspar in a basalt)?

- ❖ What are the differences in placement of granitic magmas (i.e. deep versus shallow). What is anatexis?

- ❖ Why don't we find much extrusive ultra-mafic rocks on the earth?

- ❖ What is the average composition of the crust...how did it get this way? Think about fractional crystallization...

- ❖ Draw a P-T diagram for the geothermal gradient at a mid-ocean spreading ridge, subduction zone, island arc and normal continental crust. What controls the slope?

Metamorphic Petrology Mini-Review; Metamorphic Processes, Rocks and Environments

Focus: Understanding the how metamorphic processes work, and relating them to tectonic environments.

- def. **Metamorphism** –

Agents of Metamorphism

Agent	Geological Environment

Types of Metamorphism

Type	Typical Field Observations	Geographic Location

- def. **Metamorphic Facies** –
- def. **Metamorphic Zones** –

Metamorphic Reactions, the Clapeyron equation, and the Phase Rule:

(A) Solid-Solid--

- 1.
- 2.
- 3.

(B) Dehydration/Decarbonation--

Examples;

(C) REDOX

Example;

(D) Mixed volatiles –

Write these out, and understand what they mean and how to use them:

(i) Clapeyron equation:

(ii) Phase Rule:

Phase Rule practice: For the Al_2SiO_5 system at equilibrium, on the reaction $ky = sill$, there are ___ phases, ___ components, and ___ degrees of freedom. At equilibrium, at the Al_2SiO_5 triple-point, there are ___ phases, ___ components, and ___ degrees of freedom.

Mineral Readjustments – where kinetics play a big role in P-T paths. Along a P-T path, there are three types of minerals:

- 1.
- 2.
- 3.

Metamorphic Textures & Structure – Fabric Development – what do you expect?

- A. Thermal Metamorphism;
 - Granoblastic –
- B. Dynamic Metamorphism;
 - Cataclastic –
- C. Dynamothermal Metamorphism
 - Structure; 1. Foliations
2. Lineations
 - Texture; 1. Slate – Phyllite – Schist – Gneiss
2. Lepidoblastic vs. Nematoblastic
3. Poikiloblastic vs. Porphyroblastic

When you go into the field, what should we be looking for?

1. What minerals do we see (assemblage) and how are they related texturally and structurally?
2. What could a possible protolith be (i.e., what is the bulk composition)?
3. What could the P-T path have been from the protolith, and maximum facies conditions?
4. What does this rock tell us about the larger geological and tectonic environment of the area?

facies	ESSENTIAL minerals in basaltic bulk composition
zeolite	
greenschist	
amphibolite	
granulite	
eclogite	
blueschist	

On a P-T diagram, plot the following reactions as accurately as you can: Al_2SiO_5 reactions (where is the triple-point?); minimum melting of granite; muscovite + quartz dehydration; albite = jadeite + quartz. Also, draw in the P-T regions for the facies in the preceding table.