University of California
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Teaching Portfolio

Submitted in partial satisfaction for the
Certificate in College and University Teaching

by

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TEACHING PHILOSOPHY STATEMENT

Making and synthesizing observations is foundational to being a geoscientist. I aim to cultivate this skill in my students, no matter their course level. When I taught physical geology at UC Santa Barbara, my students wrote weekly posts in our class discussion forum of times they witnessed "geology in everyday life." Through this assignment, students identified coastal erosion, hazards mitigation efforts, and the formation of sand ripples on their local beach, learning how to connect the material they learned in class with modern Earth processes. In my future coursework, students will complete projects where they collect their own samples and integrate field observations with laboratory data to make an interpretation of geologic histories. Collecting and interpreting their own data means my students will learn science by *doing* science, which will hopefully lead them to identify as geoscientists before they graduate.

I also aim for my students to develop their written, oral, and visual communication skills, as communicating both content knowledge and the results of research are key skills for all geoscientists. Regardless of their chosen career path, writing reports, proposals, and/or scientific papers, as well as presenting the results of their work to colleagues, peers, and investors, will likely be an important component of my students' livelihoods. In my physical geology class at UC Santa Barbara, students wrote one paragraph summaries on short, seminar-style talks on geoscience research topics. This was a weekly exercise where I provided feedback on the content, organization, and writing style of their work, so my students could improve their writing for the next summary or their assignments in other classes. In the future, I my students will hone their oral presentation skills in mock symposiums. Students will partake in an afternoon of conference-style talks by their peers, where they will present on a mountain range, volcano, or other geologic topic of their choice. By exploring the scientific literature on their chosen topic and presenting on what they've learned, students will gain crucial experience in distilling complex information to communicate an articulate, compelling scientific narrative.

In addition to instilling these fundamental scientific skills, my goal to be a mentor to my students permeates my teaching philosophy. Being a mentor means providing students with content knowledge *and* helping them navigate their learning experience. One way I mentor my students is by highlighting opportunities relevant to my students' futures as geoscientists about which they might not have otherwise known. This connects students with resources that allow them to envision and pursue their future geoscience careers. I also stive to adapt my mentoring style depending on my students' interests and needs. Last academic year, I took on an undergraduate mentee who is interested in a career in water resources management, something with which I have no personal experience. To be an effective mentor to this student, I helped them identify potential internships, provided feedback on their resume, and practiced interview questions with them over Zoom. My mentee was ultimately offered an internship with a company for whom they envision working long term, and last summer they worked with UC Davis faculty and graduate students on a groundwater quality monitoring project in California's Central Valley. Even when I am not an expert in a student's discipline-specific interests, I help them demystify the process of applying to jobs and graduate school and develop soft skills in interviewing and resume writing, which are applicable regardless of the direction they hope to take their lives and careers.

I am also committed to actively promoting belonging, accessibility, justice, equity, diversity, and inclusion through my teaching and mentoring. My passion for helping students from underrepresented backgrounds achieve their own academic, personal, and scientific goals stems from my own academic experiences as a first-generation college student. One frequently cited reason that students from underrepresented groups do not pursue careers in the geosciences is the lack of role models—both in industry and academia—with whom students can identify. In my teaching, I am purposeful about representing scientists from diverse backgrounds so all students can picture themselves as geoscientists. In the 2020–2021 school year, I also helped to develop and implement the Geoscience Enrichment and Mentoring for Students by Students (GEMSS) program in the Earth Science department here at UCSB. One goal of GEMSS was to increase student belonging and inclusion by providing them with mentors who helped them feel welcome by and connected to the department and who could help guide them through the "hidden curriculum" of applying to jobs and graduate school.

In summary, my role as a science educator is to facilitate student learning. It is my job to transfer scientific knowledge to my students, teach them how science is done, and instill the importance of strong communication skills. By further being a mentor and promoting belonging, accessibility, justice, equity, diversity, and inclusion, I can build a learning environment where students see their potential as geoscientists and embark on their own unique path to success. My own experiences as both a student and instructor of the geosciences provided the foundation for me to become the geoscientist that I am today, and I hope to continue to provide the classroom, lab, and field experiences for my students that are as transformative for them as my own were for me.

REFLECTION ON REQUIREMENT 1

Through serving as a TA in the lab, classroom, and field, it has been clear to me how two fundamental components of my teaching philosophy – making observations and interpretations and cultivating communication skills – both manifest in and are influenced by my TA experiences. The ways I have approached leading field and lab exercises, grading student writing, and helping students engage with scientific literature demonstrate this foundation of my teaching philosophy.

Making observations and synthesizing interpretations from those observations is a key way that I have approached teaching as a TA. One class that I that I have had the opportunity to TA multiple times at UCSB where this is particularly evident is EARTH 104B (Field Methods). In this class, students spend a week in the desert outside of Barstow, CA learning how to make geologic maps and apply what they have learned in their coursework to real rocks. Knowing that I wanted to gain experience teaching, the instructor afforded me the opportunity to lead student learning and discussions on making rock descriptions. This led me to reflect on the skills that I considered most important for students to develop in this introductory-level field course. I realized that students needed to know: (1) which observations were required to properly describe a unit so they could recognize it when they saw it again, and (2) how to use those observations to make interpretations of the environments in which those units formed (e.g., did the rock form in a river or a lake?). I led this exercise for at least seven different rock units that day, watching as my students gradually remembered each of the characteristics they were meant to be observing with increasing practice. Years later, I can see how the component of my teaching philosophy to cultivate skills in making observations and synthesizing interpretations manifested in these moments. Now, I also recognize that repetition, practice, making observations across scales, and learning science by doing science are ways I hope to cultivate skills in making observations and interpretations in my future students.

In addition to these field experiences, teaching in the lab and classroom has also developed the way I approach teaching students to make observations and form interpretations. Although EARTH 102C (Metamorphic Petrology) was the only class for which I served as a TA that was classroom-based, it had a profound impact how I plan to approach my own classes in this subject. In Metamorphic Petrology the goal is for students to learn how to identify rocks and minerals and interpret the conditions under which those rocks formed. As a TA in this class, my role was to lead the laboratory exercises in rock and mineral identification, a key skill in making observations in geology. Although the laboratory assignments themselves were already put together, it was up to me to decide how to teach students the ins and outs of identifying rocks and minerals. At the beginning of the quarter, I provided my students with a mineral identification sheet that I explained they could use to write down, in their own words, the characteristics that helped them identify specific minerals (Appendix 1). I also noted that they would be allowed to use this mineral identification sheet as notes for their lab exam. My goal in giving them this mineral ID sheet was for them to repetitively write down their observations, and in doing so allow them to learn to identify minerals through repetition. Further, each laboratory exercise consisted of a set of hand samples (rock samples about the size of a baseball) which are to be observed with their naked eye and accompanying thin sections (slices of rock so thin that light can pass through them) which are observed using a microscope. Although I did not recognize it at the time, I now understand approaching rock and mineral ID in this way allows students to connect what they observe at the macroscale (hand sample) with their microscale observations (thin sections), which reinforces their mineral identification skills. I now recognize how my experience as a TA in Metamorphic Petrology was formative for how I will approach teaching students to make observations and interpretations in my future classes: through repetition, practice, and making observations across scales.

Every class in which I have served as a TA had a written assignment. Being responsible for grading student writing has led me to consider how I can best foster my students' written communication skills. I'm grateful to have had the opportunity to attend the "grading student writing" workshop during the UC Santa Barbara-wide TA-training, from which I took away two important approaches to grading written assignments: follow a rubric and provide feedback. I have implemented both tips in every writing assignment that I have since graded. For example, in Field Methods, students are required to write a report on the geologic history of Rainbow Basin, CA, the area in which they have been doing field work. To grade these papers, I created a detailed rubric on grammar and spelling, style, organization, and content (Appendix 2). I also provided at least a half page of comments for each student regarding how the paper could have been improved; my aim was for those comments to be applicable not only to that specific assignment, but also more broadly to their future science writing (Appendix 3). In the future, I plan to provide students with the paper rubric ahead of time and require that a draft be submitted as part of the grade and for feedback prior to the final paper deadline.

Another way that I teach students to write scientifically is by having them engage with the scientific literature. It is not simply enough to assign papers to read to achieve this; students must be guided through those papers so they can learn the components of a scientific paper and how to read the literature. For example, when I served as a TA for Metamorphic Petrology, I occasionally assigned students a short paper to read as a pre-lab assignment. These papers were accompanied by a reading guide of questions to answer, which were aimed to help students navigate the paper (Appendix 4). When we met for lab, I began with a discussion of those questions, and an explanation of how each question related to the components of a strong scientific paper. If ever presented with the opportunity to teach a seminar, I would further foster written communication skills by asking my students to write a one to two paragraph summary of the papers they read, identifying the purpose, hypotheses tested, questions, approach, key findings, and significance of those written works.

REFLECTION ON REQUIREMENT 2

In preparation to teach EARTH 2 (Physical Geology) as the instructor of record in summer session A 2020, I completed the Summer Teaching Institute for Associates (STIA) in cohort 1. I have included my STIA certificate of completion as evidence of completing the course (Appendix 6). Although STIA in summer 2020 was geared towards learning to teach online, the principles I learned about writing learning objectives, creating assessments, and establishing a pattern of work with students will be applicable to all future classes that I teach, regardless of whether they are taught online.

The first exercise we completed as part of STIA was to define the learning outcomes for our course using action verbs from Bloom's taxonomic index. Prior to enrolling in STIA, I had never heard of Bloom's taxonomic index. Writing learning objectives for my EARTH 2 class was the first time I sat down to consider what it was that I wanted my students to take away from this introductory-level science class, regardless of whether they continue on to study Earth science in upper-division coursework. This exercise allowed me to hone in on two key tenants of my teaching philosophy that specifically encompass the way I teach science, with a focus on making and synthesizing observations and fostering critical thinking and writing skills. Upon reflection, these components of my teaching philosophy are evident in the learning objectives for my EARTH 2 class. For example, one of the learning objectives from my class was "Students will classify the rocks and minerals Earth is composed of and describe how different rock types form." Classifying rocks and interpreting how they form requires that students make and synthesize observations of rocks and minerals and critically draw connections between their lab assignments and the concepts they have learned in lecture.

I recognized these same pillars of my teaching philosophy in week 2 of STIA when we learned about creating assessments to evaluate student learning. In the workshop "writing formative quizzes and multiple-choice tests", I learned the different components of and how to write a good multiple-choice question. I knew immediately that I hoped to craft both multiple choice and short answer questions for quizzes and exams that my students could not easily look up the answers to online. Instead, I wanted them to think critically and apply the content they had learned in class to answer the question. One quiz/exam question that I wrote required that students arrange geologic events in relative order using the principles of relative geologic dating. The "assessments" module of STIA also provided guidance for written assignments, which I knew I wanted to incorporate in my class to cultivate my students' written communication skills. Through STIA, I learned that it's important to set expectations for written assignments by providing students a rubric when they are given the instructions. The rubric I provided for my student's one-paragraph seminar summaries (Appendix 7) allowed me to easily provide feedback that I hoped would improve student writing.

Perhaps the component of STIA that resonated the most with my teaching philosophy was in week 3 where we drafted a weekly pattern of work for our students. Going into teaching online, my biggest concern was for my students and their wellbeing. As being a mentor and creating an accessible, equitable, and inclusive learning environment are important to me, I wanted to do everything I could to guide my students through this unfamiliar learning experience. The suggestion to establish a weekly pattern of work was a fantastic way to clearly communicate the expectations and schedule for class. That way, students had all the information they needed to schedule the class into their lives if necessary. I ended up sending a weekly email every Monday morning outlining the work for class that week, with the aim of consistently communicating with my students and keeping to the same weekly pattern of work (Appendix 8).

In summary, STIA was a fantastic opportunity that not only helped me prepare for teaching my first class, but also led me to reflect on and continue to develop components of my teaching philosophy. Writing learning objectives and learning to create assessments led me to recognize that making and synthesizing observations and cultivating written communication skills are central to the way I teach, regardless of course level. Considering my students needs in an online learning environment led me to establish and clearly communicate a weekly pattern of work, which I hoped would guide students through their experience and create a more equitable, accessible, and inclusive learning environment.

REFLECTION ON REQUIREMENT 3

To fulfill requirement 3 of the CCUT, I chose to write a discussion titled "The Use of Asynchronous Videos as a Replacement for Synchronous Lectures" (Appendix 9). I taught EARTH 2 (Physical Geology) in summer session A 2020. This meant that I was teaching in the height of the pandemic and had to implement a cornucopia of instructional technologies to offer my class fully online. I opted to write my discussion on my decision to use asynchronous lectures as this was the most substantial instructional technology I used in the course and is an approach that I would consider using in my future classes.

This discussion was the first time I had really explored the teaching and pedagogy literature. I learned that there is a myriad of published literature that supports my prior intuition about the inequity, inaccessibility, and exclusion of "traditional" and even student-centered classrooms. This is literature that I plan to use in the future to counteract any pushback that I may experience from students, staff, and faculty if I decide to change the way I approach my classes (e.g., use a "flipped classroom"). For example, Ochoa and Pineda (2008) demonstrate that in student-centered classrooms, students who identify as non-white are hesitant to speak up in class discussions, even when those students make up the majority of students in the class. Using instructional technologies to move some of these discussions online could ameliorate some of the anxieties that students feel speaking up in class.

Exploring the technology-related pedagogy literature allowed me to reconcile with the way I had to approach teaching my own class for the first time. When I taught EARTH 2, it was not only my first time teaching, but it was also my first time teaching online (and I had in fact never even taken a course online as a student). I was concerned that I didn't have enough time to create quality course content for my students; I lamented that I didn't have more time to learn to teach online. Reading published work on implementing technology in teaching—particularly papers that centered on online teaching during the pandemic—helped me to recognize that everyone who taught in those early months of the pandemic was in the same situation: we had to do the best with what we were given. Harris et al. (2020) describe the rush to move all coursework online as "panic pedagogy", which required a drastic change in the way we taught in an inadequate amount of time to deeply consider precisely *how* we were teaching.

These papers also helped me to recognize that rather than view remote teaching as a missed opportunity to gain "real" (i.e., in-person) teaching experience, we should see our time in a completely remote classroom as an opportunity to innovate the way we teach when things return to "normal." For example, I walked away from my EARTH 2 class convinced that I could never see myself using prerecorded lectures in any of my classes ever again. I was frustrated that my attempts to get my students to watch the videos (a quiz at the end of every set of lectures) seemed to not be working. I also felt strongly that the way I learned best (by attending a live, in-person lecture) was the best classroom model. However, recent conversations that I've had with my teaching mentors and what I've learned from reading the literature have changed my mind. Now, I can see the benefits of using asynchronous lectures as part of a flipped classroom and would certainly consider teaching upper-division coursework using a flipped classroom style in the future. The literature that I read and discussion that I wrote for this requirement led me to recognize that creating an equitable, accessible, inclusive classroom environment is an important component of how I hope to approach my teaching in the future, and how teaching using a flipped classroom can help build a more equitable, accessible, and inclusive classroom. I do, however, still maintain that much introductory-level geoscience coursework predominantly involves the transfer of fundamental geoscience facts from instructor to student. This is groundwork that I still feel is best laid in person, in the classroom.

References

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Ochoa, G. L., & Pineda, D. (2008). Deconstructing power, privilege, and silence in the classroom. *Radical History Review*, *102*(102), 45–62. https://doi.org/10.1215/01636545-2008-012

REFLECTION ON REQUIREMENT 4

When I taught EARTH 2 in summer session A, 2020, I designed my course to integrate what I had learned students needed to thrive in an online learning environment (a regular pattern of work, flexibility, community) with what I felt were key skills and content knowledge that I wanted my students to take away from my class. For example, all lectures were offered asynchronously so that students could engage with course material whenever worked for them. All components of my course are described in detail in the syllabus, which I include here as Appendix 10. Two of my lectures for this class are publicly available for viewing at this link (radiometric dating) and this link (California water resources). In this reflection, I focus primarily on specific assignments and assessments that I gave to my students that exemplify how my teaching philosophy influenced how I taught my course, as well as how I will approach the class differently if I ever have the opportunity to teach it again.

First, I knew I wanted my students to have the opportunity to work on their writing skills in my class, as writing is an essential skill regardless of whether my students were to continue on in Earth science. To cultivate their writing skills, I decided to offer a weekly seminar that my students were required to attend and write a summary for twice over the course of session A (see Appendix 7 for detailed instructions for this assignment). In these seminars, I presented on my own research or interesting Earth science topics that I didn't have the opportunity to talk about in detail in lecture. I opted for students to write summaries of my presentations rather than say, a research paper, as I thought students might lack the confidence and content knowledge needed to get anything out of the process of writing a research paper. I provided feedback on each of the student's summaries and allowed them to rewrite them for a better grade if they chose to do so. The aim of providing feedback and letting students rewrite summaries was for students to improve their writing skills by incorporating my comments. I also offered extra credit for each additional seminar that students attended and wrote a summary for to incentivize students to acquire additional practice writing.

In addition, I wanted my students to learn how to make geologic observations and connect what they learned in class to "real life" examples of geology. One way I did this was by requiring students to post two examples of "geology in everyday life" in our class Nectir channel (the full instructions for this assignment I include as Appendix 11). I asked my students to post photos of geologic features they observed while out on a walk or news articles on geologic phenomena such as earthquakes and volcanic eruptions. My rationale for this assignment was that I hoped it would open my students' eyes to the geology that surrounds our everyday lives. For example, maybe they had never considered the geologic processes that go into water coming out of their faucet, or why ripples develop on beaches. The secondary goal for this assignment was to facilitate conversations among my students and help to build the sense of community that is difficult to establish in online classrooms. Overall, I was fairly satisfied with the back-and-forth that students had on these posts, with some posts leading to both casual conversations and more scientific discussions, which are both exemplified by a post and exchange about a feature in Lassen Volcanic National Park (Appendix 12).

Although I was happy with the class that I offered, there are several things that I would change if I were to offer it again. First, I would give students a week and a half to complete lab assignments rather than having them due on Sunday the week they were assigned. When I taught my class, my rationale for having labs due Sunday was that students would have all their work completed for the prior week before moving on to another topic and weeks' worth of work. Although some students completed the lab assignment way ahead of time, many logged onto

GauchoSpace to view the assignment for the first time a 9 PM on Sunday night, and ultimately had many questions about the lab in a timeframe where neither the TA nor I were available to answer their questions. If labs had been due say, the following Wednesday, the day my TA held office hours, this may have mitigated the issue of students attempting to complete the lab at the last minute without any guidance.

Second, I would change the way I structured the weekly seminar such that students were required to complete one five- to ten-minute presentation on an Earth science topic that they found interesting, such as geologic event (e.g., an earthquake), geology of a specific national park, or natural resource. Restructuring the seminar this way would give students the opportunity to hone their oral presentation skills, which is a key pillar of my teaching philosophy that I did not incorporate in my class. Like the Nectir "geology in everyday life posts", these presentations would also serve to help my students to recognize the societal applications of what they learned in class. I would also hope that attending their peers' presentations would build an additional sense of community among my students.

Finally, if ever even the chance to teach physical geology again, I would rely less on the textbook and incorporate more case studies and real-world examples in my teaching. Although I did incorporate some of this in my class (for example, I lectured on recent earthquakes and the 2018 Montecito debris flows) I hope to incorporate more of my own experiences as a geologist in the future. This will allow students to make connections between what they're learning in class and real-life examples and hopefully see the altruistic values of learning and applying geology.

SUMMARY ESCI REPORTS

Teaching assistant evaluations

Since beginning my graduate program at UCSB, I have had the opportunity to serve as a TA in four field classes and one classroom-based course with a lab. These field classes involved 1–3 weeks or of primitive camping or staying in field stations, hiking over rough terrain with no days off for a week straight, and long evenings working on assignments after the students have already been outside all day. Although many of my TA responsibilities were similar between the two types of classes (grading assignments, answering student questions, leading discussions) being a field TA has an additional component of serving in a camp counselor-type role. In the field, I take on additional responsibilities of helping students with gear and supplies, encouraging students with the physical challenges presented by the class, and making sure camp is running smoothly. I have opted to compare my student evaluations from my field and lab classes to evaluate where my interactions with students could be improved in these two fundamentally different classroom settings. However, I note that the sample size for the number of field students (75) is much larger than the sample size for the number of classroom students (16).

Overall, students tended to rate my helpfulness (Fig. 1) and performance (Fig. 2) higher in my field classes than in my classroom-based lab classes. I attribute this to the mentorship dynamic I am able to develop with the students in the field, my demonstration that I care about student needs when they are walking around the desert for weeks at a time, and overall more experience with field teaching than classroom teaching. For example, in EARTH 6 (Mountains, Boots, and Backpacks – Fall 2017) my students commented, "I am very thankful for Amy's patience and drive to be a helpful mentor" and "She's inspiring, caring, incredibly intelligent, and makes me want to do more." These comments demonstrate that one of the core tenants of my

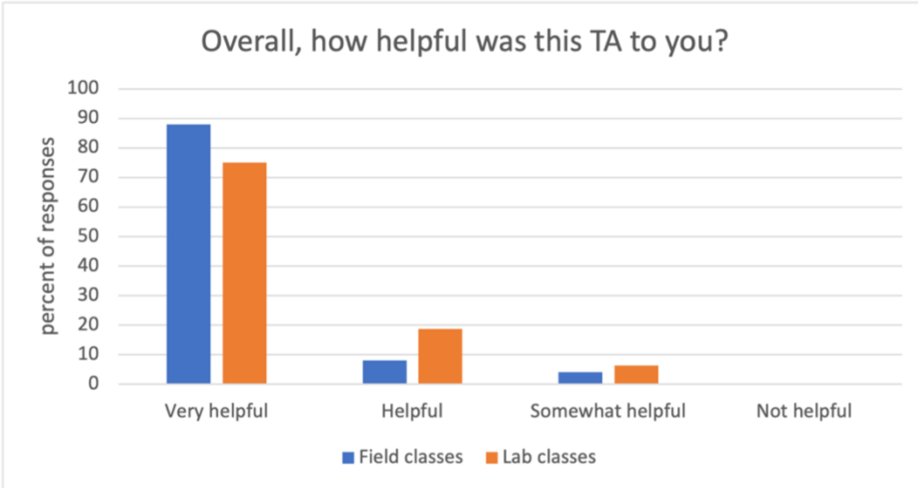

Figure 1. Student ratings of overall helpfulness as a TA, separated by field and lab classes.

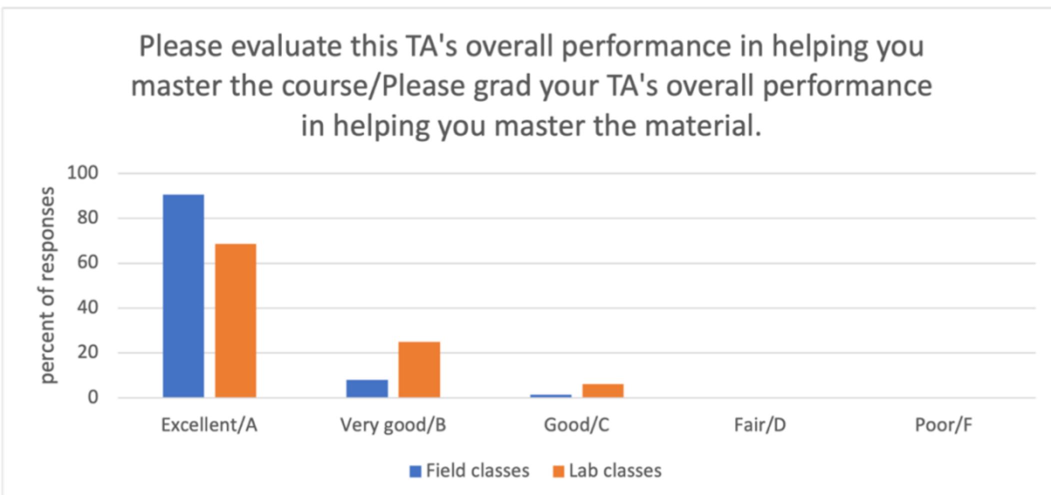

Figure 2. Student ratings of overall helpfulness as a TA, separated by field and lab classes.

teaching philosophy, to be a mentor, is evident to my students when I am able to develop relationships with them in the field.

Further, my aim to center belonging, accessibility, justice, equity, diversity, and inclusion in my teaching is most evident when I work with students in the field. Many hypothesize that the emphasis on field work in Earth science degree programs is one factor that prevents the diversification of the Earth sciences, as underrepresented minorities and students from economically disadvantaged backgrounds often have less experience with the outdoors (Finney, 2014) and/or cannot afford the specialized gear required for field trips (Abeyta, Fernandes, Mahon, & Swanson, n.d.). As a field TA, I often hike at the back of the pack with students who move more cautiously over rough terrain and constantly check in with students to make sure they have everything they need. This has a clear positive impact on my students. In EARTH 6 (Mountains, Boots, and Backpacks – Fall 2017) one student commented, “Amy was very patient and understanding with students who could not handle the physical activity.” And, in EARTH 104B (Field Methods – 2018) another student said, “She made an effort to get to know each person despite the fact the course was only a week long, in order to better assist each individual need.” These comments demonstrate that in demonstrating to my students that I care about their well-being, I can continue to cultivate a more inclusive field classroom.

I hope that my overall instruction in the classroom and lab setting will improve as I gain additional experience with these more “traditional” types of classes in the future. Serving as a TA for EARTH 102C (Metamorphic Petrology – Fall 2018) was the first time I was ever responsible for running a lab. This meant that I did not yet know the best way to approach teaching students to identify rocks and minerals, to make those observations and interpretations, which are central to my teaching philosophy. I decided to start every lab with a short lecture on the minerals and their properties that students would be working with in lab that day. Although many students commented in the ESCI evaluations that they found this helpful, multiple students also commented that they thought it would be more helpful to connect a live microscope feed to a projector, so that they could see the minerals in real time. This is a fantastic

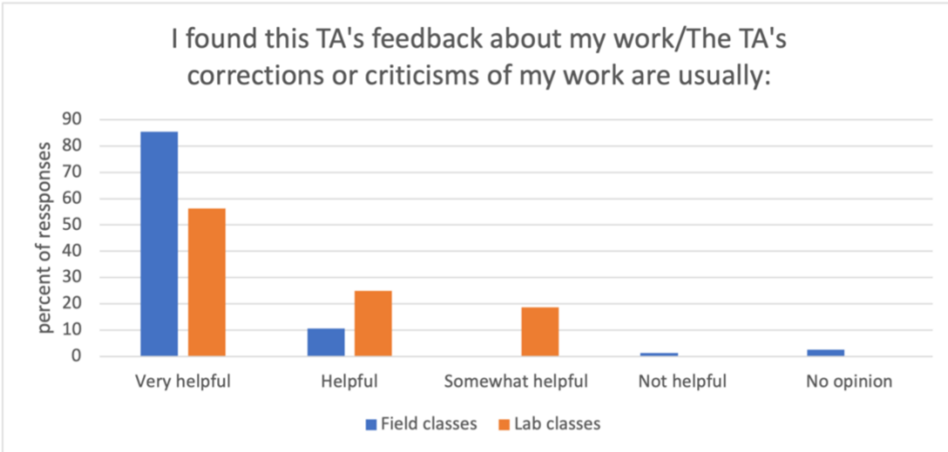

Figure 3. Student ratings on TA feedback, separated by field and lab classes.

suggestion from my students that I plan to incorporate in my future teaching in order to better cultivate their skills in making observations and interpretations.

One aspect of my teaching that my students rated differently in the field compared to in the classroom was the quality of my feedback (Fig. 3). In the field, 85% of students rated my feedback as “very helpful”, whereas in the classroom, only 55% of students rated my feedback as “very helpful.” Providing feedback to students is a key way that I aim to develop their skills in making, observations, synthesizing interpretations, and scientific writing. Although none of my students directly commented on my feedback, the difference in the ESCI scores between the two types of classes led me to reflect on feedback that I provided to students. In my field classes, my feedback to students came in the form of comments on their work while they were actively making observations in the field and detailed feedback about their writing (Appendix 3). In the field, students complete nearly all their work in the presence of their instructors, which means I am constantly providing feedback while they are making maps and reports in the field. When I give feedback on student writing, I am purposeful about providing comments regarding how their writing could be improved that I aim for students to implement in other writing assignments. Both of these aspects of my feedback to students were absent when I served as a teaching assistant for 102C (Metamorphic Petrology – Fall 2018) which is classroom based. Many students complete their labs outside of the allotted laboratory time and I never had the opportunity to grade and provide feedback on student writing. Further, my feedback on their assignments predominantly consisted of indicating which answers were correct or incorrect. To improve my feedback on student assignments in the classroom and better achieve my goal of helping them learn to make observations and interpretations, I need to be sure that my feedback is thoughtful. In the future, I will always give students the opportunity to revise their laboratory assignments and problem sets for a better grade and include some more concrete suggestions that may lead them to the correct answer.

Another aspect of my teaching that student comments indicated that I could be more consistent with is answering student questions. In their evaluations, students in both my field and lab classes noted that I answered questions effectively (Fig. 4), was candid about my expertise regarding the questions they had (Fig. 5), and created an environment where students felt comfortable asking questions (Fig. 6). Many students commented that they appreciated my approach of leading students to the correct answer. For example, one of my EARTH 6 (Mountains, Boots, and Backpacks – Fall 2017) students commented that "Amy helped engage me in conversation so that I could come up with the answer on my own through her guidance." In 102C (Metamorphic Petrology – Fall 2017) another student said that "she is really good at helping students come to answers without giving the answer out, which helps us learn how to think about things more deeply on our own."

Despite these positive comments, my reaction to student questions often left students

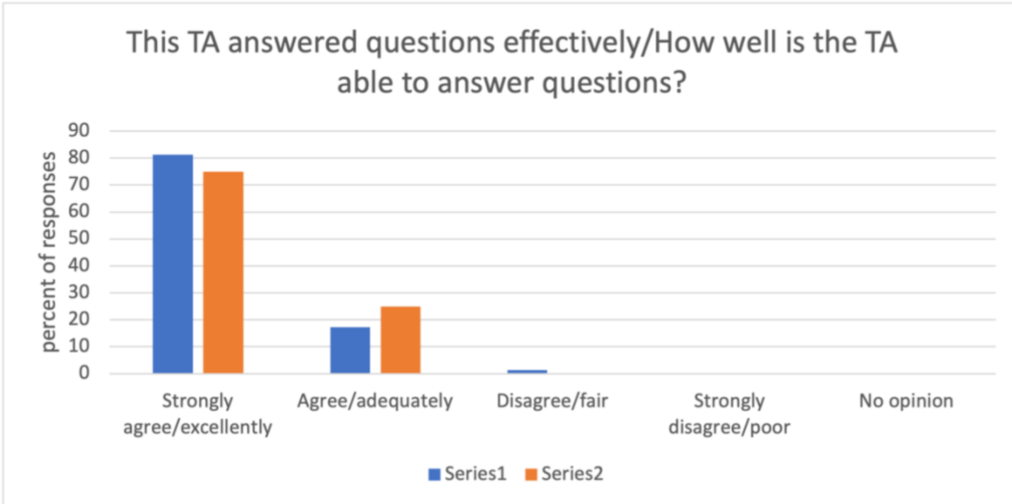

Figure 4. Student ratings of answering questions effectively, separated by field and lab classes.

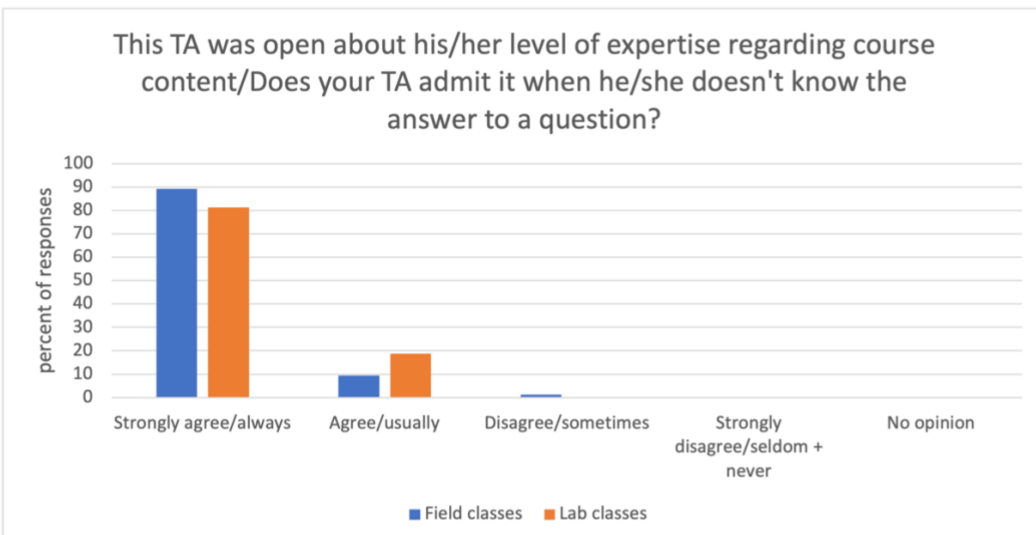

Figure 5. Student ratings of my candor regarding my expertise when answering questions, separated by field and lab classes.

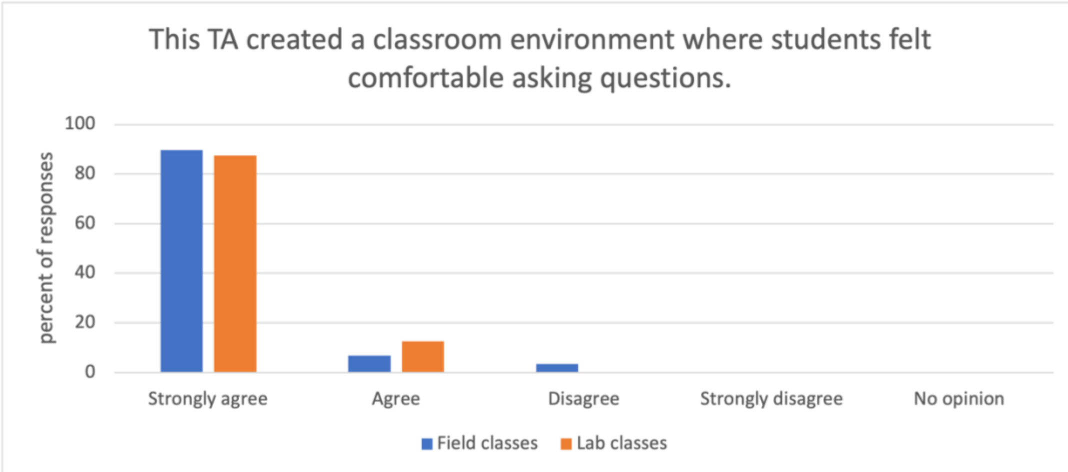

Figure 6. Student ratings of classroom environment for asking questions, separated by field and lab classes.

disheartened. In EARTH 6 (Mountains, Boots, and Backpacks – Fall 2017) a student mentioned that I "seemed visibly frustrated when I [the student] didn't understand a concept" and another in 102C felt that I was "more attentive to other students" and "with other students I'd [the student] hear her lead them to an answer". These students have picked up on a challenge of my teaching that I am aware of and always working to improve: patience when answering student questions. I never want my students to hesitate to ask questions out of concern that I may grow frustrated with them when they cannot see where I am trying to lead them. Being equally patient with all students is a way I aim to establish a classroom where students feel they belong and are included.

Instructor of record evaluations

Unlike my TA evaluations, my instructor evaluations for my EARTH 2 (Physical Geology – Summer 2020) class only consisted of two questions where students rated the class and my teaching on a scale of poor to excellent and two open-response questions. Thirteen out of

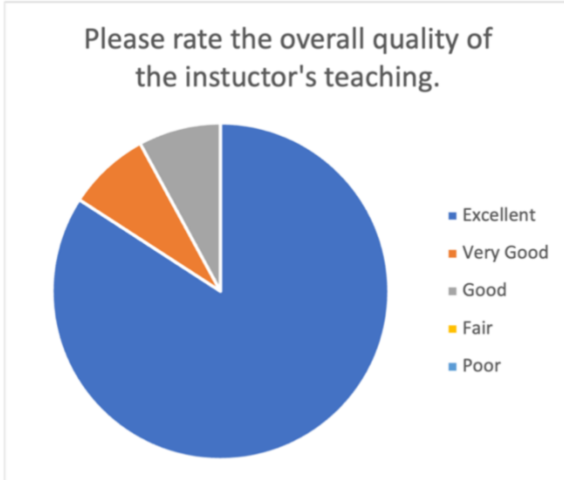

Figure 7. Student evaluations of my overall instruction in EARTH 2 (Physical Geology).

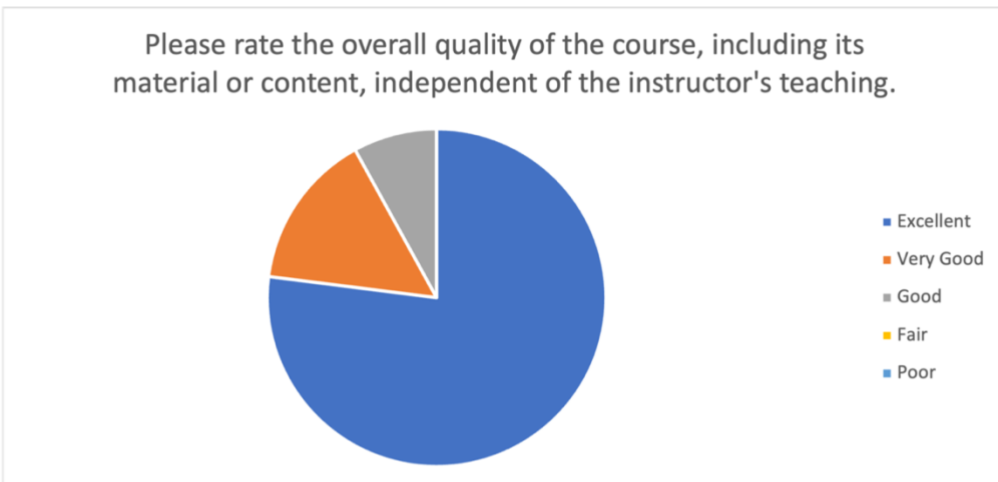

Figure 8. Student evaluations of the quality of my EARTH 2 (Physical Geology) course.

twenty-five students submitted ESCI evaluations for this course. Overall, 85% of students in my EARTH 2 class rated the quality of my teaching as “excellent”, 8% rated my teaching “very good”, and 8% rated it “good (Fig. 7). These ratings were similar to how students rated “the overall quality of the course” with 77% of students rating the course as “excellent”, 15% of students rating the course as “very good”, and 8% of students rating the course as “good” (Fig.

8). I hope the small difference between the students who rated my overall teaching and the course as "excellent" reflects the effort I put in to communicate with my students in an online environment, manage their cognitive load, and relate what my students were learning to real life.

Student responses to the open-ended questions provide more insight into why students ranked my teaching and my class the way that they did. First, students appreciated the structure of the class and my efforts to be in regular, clear contact with them. One student commented that, "The class is very structured, every week there is a road map of what to expect." Another student said, "The instructor provides precise and well-organized information every lecture and is very clear in communicating with students, whether it's regarding expectations, due dates, etc." I had learned in STIA that clear communication in an online class setting was something that students valued, and I knew I wanted to do everything I could to effectively communicate with my students in order to build an accessible classroom.

Managing my students' cognitive load was another way that I aimed to build an accessible and inclusive online classroom. One student commented that the "lectures were well organized, and I enjoyed that they were broken down into smaller videos," indicating that my students appreciated my efforts to break up the course into manageable portions. However, when asked what they would change about the course, multiple students commented that they found the lab exercises to be a little overwhelming. In response to what they would change about the course, one student said, "less extensive labs." Another student commented that they thought "the labs could be fixed a little. I found the week 4 lab to be pretty hard, and I was confused on it for quite a bit." This likely reflects that rather than build new labs for the online classroom, we adapted the in-person labs for online assignments. They way students felt about the lab exercises might change if we were more purposeful in designing the online lab exercises.

Finally, one way I hope to continue to change my teaching moving forward is to connect my own Earth science experiences with my teaching, demonstrate how what students are learning in class is relevant to real life, and focus on the more altruistic values of Earth science work. This last point may be particularly important for getting more students who identify as underrepresented minorities to pursue and stick with the Earth sciences. I began to implement these components of my teaching philosophy in my EARTH 2 class with weekly seminars, which students seemed to appreciate. One student commented that they "really enjoyed the material and the Wednesday seminars because it was all very connected to real life experience."

References

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Finney, C. (2014). *Finney, Carolyn. Black faces, white spaces: Reimagining the relationship of African Americans to the great outdoors.* UNC Press Books.

REFLECTION ON REQUIREMENT 5

This past February, I had an interview for a tenure-track position at a liberal arts college. In one of my one-on-one meetings with faculty, I was asked how I would teach a class in mineralogy and petrology. I went into an explanation of the themes and learning goals I would have for my students in such a class, but the professor stopped me and said, “I want to know the nitty-gritty of how you would teach students to identify rocks and minerals.” I paused, a little taken aback, as somehow their question was not one that I had considered. I talked in circles for a bit, but eventually got to an answer: by having students make observations across scales and repetition. Creating my CCUT portfolio has allowed me to continue to develop and solidify my teaching philosophy and more clearly see how my teaching philosophy manifested in my prior teach experience and will manifest in my future teaching. As a result, I will be more prepared for both future interviews and courses that I hope to teach in the future.

For example, in writing my CCUT portfolio, I have realized that tying in my own experiences, as well as using real data and case studies, is something that I have used in my courses in the past, but I hope to utilize more in the future. I believe doing so is a fantastic way to teach students to make observations and interpretations, as well as cultivate critical thinking skills. Students in my classes have commented that they appreciated these links between what they are learning in class and the real world, which may indicate that they are drawn in and more engaged with the material as a result.

Most importantly, writing my CCUT portfolio has allowed me to recognize that centering belonging, accessibility, justice, diversity, equity, and inclusion does not have to be presented as a separate component of the way that I teach; it can be an integral tenant of my teaching philosophy. I now see how these values are woven through many of the pillars of my teaching philosophy. For example, in being a mentor to my students, I hope to help students from underrepresented backgrounds to navigate their academic experiences so that all students may have the tools they need to succeed. Being mindful of the differing needs of students will also help me to create equitable and accessible classrooms in the future.

Overall, writing the CCUT portfolio has allowed me to become more confident in my abilities as an instructor. I am excited to use what I have learned about my own teaching in my future coursework to create transformative classroom, field, lab, and research experiences for my students.

APPENDIX 1. Mineral ID sheet provided to students in EARTH 102 C (Metamorphic Petrology) lab

Mineral Name & symmetry	***Composition***	***Length-fast/slow***	***Color/ Pleochroism***	***Birefringence***	***Extinction***	***relief***	***Cleavage***	***Other (habit, alterations, twins, etc.)***

APPENDIX 2. Rubric used to grade student papers in EARTH 104B (Field Methods)

EARTH 104B: Field Methods
Final Paper Rubric

Grammar and spelling 10 pts
- 10 – excellent
- 8 – more than one or two errors
- 5 – frequent errors that make paper difficult to read
- 0 – incoherent

Style (e.g. word choice, sentence structure, written scientifically, tense consistent) 10 pts
- 10 – excellent
- 8 – a few awkward phrases, but overall good
- 5 – several awkward sentences that make the paper difficult to read
- 0 – incoherent

Organization 10 pts
- 10 – excellent, everything in the right place and paper flows well
- 8 – good, some jumping around, but well-organized overall
- 7 – fair, jumping around makes paper a little difficult to follow
- 5 – observations not separated from interpretations
- 0 – sections not broken out in any sense, intro, methods, data and observations, interpretations, and conclusion all jumbled in together

Introduction 5 pts
- 5 – excellent introduction, clearly outlines the purpose of the study
- 3 – fair introduction, makes an attempt to outline the purpose but doesn't quite capture it
- 0 – introduction completely missing or 100% off topic

Methods 5 pts
- 5 – excellent, mentions brunton, mapping, rock descriptions
- 4 – good, mentions at least brunton and mapping
- 3 – fair, mentions one of the three methods
- 0 – methods sections completely off topic or missing

Data and Observations 30 pts
- Stratigraphy
  - Pickhandle (5 pts)
    - Volcanic
    - Clast size and sorting, roundness
    - Bedding?
    - Clast composition
    - Matrix
    - fiamme
  - Mud Hills formation (15 pts - this should be a lot of points w/in stratigraphy)
    - Indicates stratigraphic order of units (3 pts)
    - Describe the various members (12 pts)
      - 2 pt each for lithologic description (8 pts)
      - 1 pt each for describing the contacts between each unit (4 pts)

Owl Canyon Conglomerate (5 pts)

- Clast size
- Clast composition
- Rounding
- Sorting
- Bedding thickness/how are beds defined?
- Carbonate cap

Rainbow member of the Barstow formation (5 pts)

- Buttress unconformity (1 pt)
- General RM description (1 pt)
- All (mapped) marker beds mentioned (3 pts)

Structure (10 pts)

- Faults (5 pts)
  - Normal faults in northern map area (1 pt)
  - Normal faults in Owl Canyon Conglomerate & Rainbow member (1 pt)
  - Faulted contacts in Mud Hills formation (1 pt)
  - Two large-displacement strike-slip faults (1 pts)
  - One of the large-displacement strike-slip faults offsets syncline axis (1 pt)
- Orientation of bedding (1 pt)
  - Describe how the orientation of bedding changes in northern part of map area
- Folds (4 pts)
  - Owl Canyon defines syncline (2 pts)
    - Is syncline (1 pt)
    - Orientation of syncline axis (1 pt)
    - Indicate how know is syncline (2 pt)

Interpretations 30 pts

- Written like telling a story rather than "answering the questions" and smooshing them together (5 pts)
  - Excellent
  - Good
  - Fair
  - Poor
  - Unacceptable
- Geologic history (25 pts)
  - Pickhandle depositional setting (2 pts)
    - What is it (1 pt)
    - How do you know (1 pt)
  - Mud Hills depositional setting (6 pts)
    - What is it (2 pt)
      - Talus cones
      - Adjacent to stream
    - How do you know (2 pt)
    - Statement about active faulting and tectonic activity OR topography (1 pt)

        - Source of clasts (1 pt)
    - What does buttress unconformity imply and why (2 pts)
    - Owl Canyon depositional setting (4 pts)
        - What is it (1 pt)
        - How do you know (1 pt)
        - Statement about tectonic activity/faulting waning (2 pt)
    - Rainbow member depositional setting (4 pts)
        - What is it (1 pt)
        - How do you know (1 pt)
        - Interpretation about tectonics and active faulting (2 pt)
    - Pre-tilting/folding faults (3 pts)
        - **this could be many different parts in paper – as long as it is woven well into the narrative
        - Which faults are pre-tilting/folding faults (1 pt)
        - How do you know (1 pt)
        - What does imply about tectonic setting (1 pt)
    - Folding (1 pts)
        - When did folding occur and how do you know (1 pt)
    - Post-folding faults (3 pts)
        - Which faults occurred after folding (1 pt)
        - How know (1 pt)
        - What does imply about tectonic setting (1 pt)

Conclusion 5 pts

5 – Excellent conclusion, clearly summarizes major points of paper
4 – Good conclusion, missing one or two major points
3 – fair conclusion, gets the point across but missing key aspects
0 – conclusion missing or off topic

APPENDIX 3. Example of feedback on student writing from EARTH 104B (Field Methods)

Grade: B (84%)

Introduction: Be sure to include an explicit statement on the purpose of the study and the report. The information on the location of the study area and why it is important are good.

Data and Observations: Excellent job being clear about the stratigraphic order of the various units within the Mud Hills and the type of contact between each unit. Don't forget to include the bedding thickness when describing sedimentary units. Also, be specific as possible with your data. For example, in the section on strike-slip faults, you note the amount of offset in the syncline axis can be observed in Figure 2. I would suggest including the number for offset in the paper, and still refer your readers to the figure. Same for the orientation of the syncline axis. You include the plunge of the fold axis, but you don't include the trend of the fold axis.

Interpretation: For the most part, you did a good job of indicating which of your observations inform your interpretations, but be sure to always do this. For example, you state the Owl Conglomerate was deposited in an alluvial fan, but it's not clear how you know that. Further, the bulk of your interpretation focused on the depositional environment of the units, and there was nothing about how the tectonics of Owl Canyon evolved through time. As an example, you could have discussed what the evolution from tall cliffs to alluvial fan to playa lake implies about the tectonics of the area.

Organization: Don't add new observations in the interpretations section. For example, the first time you bring up the shallowing of beds towards the syncline axis is in the interpretation. This belongs in the fold section of data and observations.

APPENDIX 4. Reading guide given to students as pre-lab assignments in EARTH 102C (Metamorphic Petrology)

Metamorphic Petrology
Earth 102C
Prelab – Ivera one
Fall 2018

Assignment: read *Barboza et al., 1999* and answer the following questions

1. What is anatexis?

2. What is a contact aureole?

3. What is the purpose of this paper? Include what, and where, is the Ivera zone in your answer.

4. What evidence supports the interpretation that the Mafic Complex was emplaced at pressures lower than those experienced by the lower crustal rocks during peak metamorphism?

5. How did the "stronalite" form? Was the Mafic Complex the heat source that generated this rock type?

6. What is a leucosome?

7. What is the main finding of this paper? What data and observations presented in the study support this interpretation?

8. Why are the results of this study significant for our understanding of the composition and structure of the lower crust?

APPENDIX 5. Instructional Development TA Development Program consultation letter

TA DEVELOPMENT PROGRAM
INSTRUCTIONAL DEVELOPMENT, UC SANTA BARBARA
1130 Kerr Hall 805.893.4289 http://oic.id.ucsb.edu/ta-development-program

TO: Amy Moser DATE: 4/11/22
FR: Evan Murnane, Consultant
RE: Video Consultation on 3/9/22

PREVIEWING DISCUSSION: You explained to me that you were a 5th year in the Earth Science department, and the teaching observation we viewed occurred while you were the instructor of record for Earth 2, an intro course in the Physical Geography program. The class covers topics including plate tectonics, geology and geological time scales, rocks, minerals, landscapes, surface processes, geomorphology and climate, and was undertaken entirely online via Zoom during Summer Session A in 2021. The specific session we viewed together was an intro to the science of climate change.

During our conversation I asked about your teaching background, and you described a breadth of experience as an educator in geography and earth sciences. An aspect of your teaching philosophy I was able to glean from this conversation was that you actively sought to have your students engage in immersive and interactive experiences with the material, by organizing experiences for students in the field, leading outdoor classes during your MA degree, etc. Considering that this Earth 2 course was your first experience teaching a class entirely online, it was notable how you had endeavored to bring that kind of learning to your students in an online context.

Since we only observed a pre-recorded video lecture for our consultation, I relied on asking you about student responses to the course, assessment strategies, and overall engagement, more on that below. You clarified for me a few aspects of the Earth 2 course that you had designed—Lectures were pre-recorded and uploaded, and were deliberately kept on the shorter side, usually less than 20 minutes each, with three chapters per week. These sets of chapters formed weekly thematic blocks in the course material. The video of your teaching we discussed was the intro lecture in the climate block. In addition to viewing the lectures at home, students were expected to read the corresponding chapter, engage in guided learning explorations, and answer short weekly quizzes. There was also an online lab component, as well as a nectar chat where students were required to post discussion responses about geology's relevance to people, society, or their own lives. Finally, you also made available a once-per-week synchronous 30 minute seminar-style discussion or bonus lecture for students. This was especially beneficial for getting some face-time with students on Zoom, and to be able to answer their questions or address their interests.

VIEWING DISCUSSION: In our discussion about your teaching, we talked about the pros and cons of face-to-face vs. prerecorded lectures, and the challenges of online teaching overall: especially how to effectively assess student learning in remote teaching, and how to bring life to the digital classroom where distractions abound and students can be otherwise engaged.

We had an interesting discussion of the positives and negatives of the flipped classroom model, which was reflected in your design of the course. Positives included having pre-recorded lectures at home, which allows students to pause and rewind, view slides at their own pace, and rewatch or review at their discretion. Ideally it would also enable more student time spent with the instructor to be focussed on experimentation or doing traditionally homework-type activities under their guidance. A particular downside to the flipped classroom model you articulated consisted in a lack of accountability. As with so many pedagogical techniques, this model works very well for self-motivated or autodidactic students, but many others may use it as an opportunity to get by doing even less work than would otherwise be required of them. We concluded from this discussion that in all our teaching, and in remote or online teaching especially, we have to build that accountability into the structure of our course by designing assessments that give us regular check-ins on student progress.

When I asked you about assessment, you expressed that you had some difficulty implementing good assessments in the remote course. I recall an anecdote you told about advising an undergraduate on their senior thesis project, and how rewarding it was for you to see the student progress and reach a high level of competence in the material, evinced by their ability to speak fluently about the project in their own words. For this reason you said that your ideal assessments would involve short answer or essay exam questions, instead of open-book multiple choice exams, which lack accountability and rigor. You mentioned this had worked well in particular for the synchronous bonus lectures, after which students wrote one-paragraph summaries. We discussed in general how good assessments allow us to identify not only gaps in student learning, but through patterns in those gaps, we may also come to identify gaps in our teaching, that can be subsequently amended to improve student integration of the material. Multiple-choice questions have their place for assessing certain information, and they can be automatically graded saving instructor time, but I think implementing more short-responses, particularly as a low-to-no-stakes form of assessment, can be an excellent way to better get to know your students and their progress even in a remote learning environment.

We also remarked on some formal aspects of the video lecture—the presentation was well organized and delivered, with delimited topics, and slides that you took us through with clarity. We talked about incorporating a concluding slide at the end, or something that would function to wrap up the topics you had covered, and emphasize your intended take-aways from the lecture. One idea to this end that we brainstormed together was to strategically include follow-up question slides, either in transitions between topics or at the end of the presentation, in order to encourage and make space for student reflection in their own words—e.g. “describe in your own words how the greenhouse effect works” or “how do feedback loops contribute to the warming of the earth?”

SUMMARY: Being forced into remote teaching has presented educators across disciplines with many difficulties: student engagement, assessing student learning, and a perennial distance or lack of in-person and hands on experiences have exacerbated the already challenging task of designing an effective introductory or gen-ed course. I’m heartened by teachers who despite this are still devoted to improving their methods, by creatively coming up with solutions for assessment, accountability, and community-building in the, albeit sometimes digital, classroom. It’s clear to me from our discussion that you are committed to these principles, which were easily detectable in your teaching philosophy and passion for the material and your students.

-Evan

To download your video simply go to gauchocast.ucsb.edu, and login using your UCSBnetID. Then search for your name. Open your video, and look for the download (arrow) icon in the upper right corner. Clisk on the icon, and your video will download.

I hope you find the strategies that we discussed to be effective. Thank you for an enjoyable discussion about your teaching, and good luck with your future endeavors.

If you would like to arrange for additional video tapings to improve your instructional skills, conference presentations or job talks, please email us at id-tavideo@ucsb.edu. You may also arrange for a consultation without a recording to discuss teaching and learning issues.

Appendix 6. Summer Teaching Institute for Associates certificate of completion

Summer Teaching Institute for Associates

University of California, Santa Barbara

This is to recognize

Amy Moser

for completion of the Summer Teaching Institute for Associates,
a program designed to promote effectiveness and scholarship in college and university teaching.

The UCSB Summer Teaching Institute for Associates (STIA) supports graduate student instructors who have responsibility for an undergraduate course during Summer Sessions. The STIA Associate has completed a series of online assignments, cooperative peer review, pedagogical skills training activities, and mentoring meetings with a UC faculty member. Specific topics include:

- Course planning; syllabus design and review
- Student learning outcomes
- Course and lecture planning
- Giving lectures; active learning
- Designing and grading assessments
- Giving and receiving feedback on learning
- Issues common to first time instructors
- Online teaching and learning

Leesa Beck
Director of Summer Sessions

Mindy Colin, Coordinator
STIA Program

George Michaels, Executive Director
Instructional Development

Leila Rupp
Interim Graduate Dean

2020

APPENDIX 7. Assignment instructions for seminar summary provided to students in EARTH 2 (Physical Geology)

Assignment: Seminar attendance and summaries
Physical Geology (Earth 2)
Summer session A 2020

Description

During our regular course lectures, I will highlight the most important Earth features and processes covered by your textbook. In addition to an overview of our planet, I hope this course will also give you an idea of what it means to be a geologist. Every Wednesday at noon, I (or your TA, Evan) will give a 30 minute talk via zoom on our own experiences in geology, emerging research topics in Earth science, or other interesting Earth features that we won't have time to cover in the regular lecture or in the lab exercises. The links to the zoom meetings can be found here and the schedule of topics can be found at the end of this document.

Requirements

You will be required to attend two of the live zoom seminars and submit a one paragraph summary of each talk you attend. You should attend one talk in the first three weeks of the course (either June 24th, July 1st, or July 8th) and one talk in the second three weeks of the course (July 15th, July 22nd, or July 29th). To get credit for the seminar that week, you must submit your one paragraph summary by 11:59 PM the following Sunday. For example, the summary for the June 24th seminar will be due June 28th at 11:59 PM. You will submit your summaries via GauchoSpace.

What should my summary include?

Your summary should consist of at *least five sentences* include:

1. A topic sentence that captures the main topic of the seminar talk.
2. Several supporting sentences that highlight the main points of the talk
3. Any questions you have about the talk/topic, something you didn't understand about the material presented, or something you learned that you found particularly interesting.

Grading

Your summary will be graded out of five points based on the rubric on the following page. There is an example summary included below. I will return graded summaries with feedback within the week, and you will be allowed to rewrite and resubmit an edited summary for a better grade any time by the end of the quarter. For each additional seminar you attend and submit a summary for, you will receive 0.25% extra credit on your final course grade. For example, if you attend four additional seminars and submit four additional summaries, you will receive 1% extra credit on your final course grade.

Example summary

This is an example summary as if Wegener and continental drift were a seminar topic.

The continental drift hypothesis states all of Earth's continents were once conjoined in a singular super continent and later "drifted" to their current positions on Earth's surface. One of the first people to compile evidence and strongly argue for continental drift was the German scientist Alfred Wegener in the early 1900s. Wegener noticed the similarly-shaped coastlines of continents and pieced them together in a supercontinent called Pangaea. The existence of this supercontinent at some time in Earth's past could explain similar rock types on multiple continents, the occurrence of the same fossils on continents that are now separated by thousands of miles, and evidence of climate that used to be much different on some parts of earth. Ultimately, the scientific community rejected Wegener's hypothesis because he could not explain how or why the continents had drifted apart. Given the good evidence in support of Wegener's hypothesis, it is interesting the geologists of his time simply rejected his idea, rather than try to find the answer to their question.

Summary rubric

Score	Content	Organization	Style	Grammar
5	Excellently captured the main points of the talk without including any non-essential information.	Began with a clear topic sentence. Each supporting sentence flowed logically to create a coherent paragraph	Summary was easy to read, clear, and concise.	No spelling or punctuation errors
4	One of the points discussed was tangentially related to the talk but not one of the main takeaways of the seminar.	Did not include a topic sentence or the position of one of the supporting points disrupted the flow of the paragraph	One or two awkward phrases, strange word choices, or unnecessary filler words	One or two spelling or punctuation errors
3	Two of the points discussed were tangentially related to the talk but were not the main takeaways of the seminar.	Did not include a topic sentence and one of the supporting points disrupted the flow of the paragraph, or two of the supporting points disrupted the flow of the paragraph	Multiple awkward phrases, strange word choices, or unnecessary filler words	Multiple spelling or punctuation errors
2	Three of the of the points discussed were tangentially related to the talk but were not the main takeaways of the seminar.	Did not include a topic sentence and two of the supporting points disrupted the flow of the paragraph, or three of the supporting points disrupted the flow of the paragraph	Every sentence has an awkward phrase, strange word choice, or unnecessary filler words	Every sentence has at least one spelling or punctuation error
1	All points discussed in summary were tangentially related to the topic but were not the most important takeaways from the seminar.	Did not include a topic sentence and three of the supporting points disrupted the flow of the paragraph, or four of the supporting points disrupted the flow of the paragraph	Every sentence has multiple awkward phrases, strange word choices, or unnecessary filler words	Every sentence has multiple spelling or punctuation errors
0	The summary was entirely off-topic.	Order of sentences makes the summary impossible to follow	Sentence structure made the summary entirely unreadable	Spelling or punctuation errors made the summary unreadable

APPENDIX 8. Example of weekly email sent to students in EARTH 2 (Physical Geology)

Hi everyone,

Well, here we are! We've arrived at the last week of the course. Just a few more days to go and you'll all officially have your geologist-in-training certificates.

This week in lecture we're covering two topics: climate and the geology of North America. There are no Guided Learning Explorations this week. Here's your roadmap:

1. Do the (recommended) textbook reading on climate, watch the five lectures, and take the climate quiz by Friday, July 31st at 11:59 PM.
2. There is no reading to go with the Geology of North America lectures, just three lectures and a quiz that you should complete by Friday, July 31st at 11:59 PM.
3. Study for your final exam!
4. Read over the climate lab early in the week so you are prepared to come to Evan with questions either during his office hours on Wednesday, July 29th or the Zoom lab section on Thursday, July 30th. The climate lab is due this Sunday, August 2st at 11:59 PM.
5. Attend the Wednesday Zoom seminar at noon this Wednesday, July 29th, and submit your summary by Sunday, July 29th at 11:59 PM to get credit for attending the seminar. Don't forget about the extra credit available for extra seminar attendances and summaries!
6. Come to office hours! I will be holding office hours on Zoom Tuesday from 3–4 PM and Friday from 10–11 AM. Evan will have office hours Wednesday from 11 AM–12 PM.
7. Your midterm exam will take place this Friday, July 31st from 4–7 PM. I will send out an email later today with more information about the final.
8. Post an example of geology in everyday life in the class Nectir discussion by 11:59 PM on Sunday, August 2nd if you'd like to get credit for posting this week. You should also be sure to respond to at least three of your peer's posts to get full credit for your Nectir posts grade.
9. If you would like to replace your lowest lab grade, you may do so by completing the assignment outlined here by 11:59 PM on Sunday, August 2nd.
10. Hopefully you received an email about ESCI online course evaluations. To those of you who have already completed the online course evaluations – thank you! These anonymous surveys will be available until Friday, July 31st at 11:59 PM, and I will not see the results until after your final course grade has been assigned.

That's all for now. Happy geologizing!

Amy

Appendix 9. Discussion on the use of asynchronous videos in my EARTH 2 (Physical Geology) class to fulfill CCUT requirement 3A

INTRODUCTION

Teaching EARTH 2 (Physical Geology) as the instructor of record in Summer Session A meant creating a rigorous, transformative classroom experience that integrated lab and field exercises using entirely remote teaching techniques. To tackle these challenges, I incorporated many instructional technologies in my class that I might not have otherwise used. All quizzes and exams were offered as timed, open-noted GauchoSpace quizzes. Lab exercises – including a virtual field trip with videos I recorded myself – were moved to be entirely online exercises on GauchoSpace. I created a class Nectir channel hoping it would simulate the social component of the in-classroom experience. I assigned "guided learning explorations," interactive online assignments offered by the course textbook in an effort to get my students to interact with the course material and not just passively absorb it in the lectures.

Perhaps the most substantive instructional technology that I employed in my EARTH 2 class was using GauchoCast/Panopto to offer lectures to my students in an exclusively asynchronous format. I opted to provide all of my lectures asynchronously so both I and my students could have the most flexibility when engaging with course content in what was then still the uncertainty of the first four to five months of the pandemic. In this discussion, I have decided to focus on this specific element of my instructional technology use. This permits me to more critically and thoroughly analyze a singular component of my instructional technology that I incorporated in my teaching in response to the pandemic, and as a result may consider continuing to use in my future courses

Here, I will discuss my use of asynchronous videos as a replacement for synchronous lectures when I taught EARTH 2 (Physical Geology) in Summer Session A, 2020. First, I will discuss the challenges and limitations that I experienced regarding student engagement with the pre-recorded lectures. Second, I evaluate the benefits that offering pre-recorded lectures provides to accessibility of course content. I end the discussion with how I foresee the effective use of asynchronous lectures as part of a "flipped classroom" for future upper division coursework.

CHALLENGES AND LIMITATIONS OF ASYNCHRONOUS LECTURES

From my online teaching experience and published literature, the biggest challenges or limitations associated with asynchronous lectures, be it in a fully online class or a "flipped classroom", are student accountability and student engagement (Choe et al., 2019; Harris et al., 2020; Herreid, Schiller, Herreid, & Wright, 2014; Prud'homme-Genereux, Schiller, Wild, & Herreid, 2017). Here, I define accountability as having an incentive to watch the lectures and engagement as the interaction of the students with the lecture material. Accountability and engagement in an online classroom are important for several reasons. First, in an online classroom, all work takes place outside of the classroom. Attending lecture basically becomes "homework" and does not have the same built-in accountability of attending class that synchronous classes do. Second, the degree to which students engage with lecture videos contributes to increased learning of course material and the degree to which students are motivated to continue with their education (Lei, Cui, & Wenye, 2018; Meyer, 2014). The challenge is that watching a prerecorded lecture is a passive action; a student is not necessarily engaged with the content itself (Chi & Wylie, 2014).

Increasing student accountability and engagement can be achieved by many of the same techniques. Many published works suggest that providing an incentive for students to watch the asynchronous lectures is key (Brame, 2013; Herreid et al., 2014; M. K. Kim, Kim, Khera, & Getman, 2014; Prud'homme-Genereux et al., 2017), and note that this can be achieved by a quiz or other assignment given at the end of a lecture of set of lectures (Prud'homme-Genereux et al., 2017). These quizzes and assignments also serve to motivate students to engage with the lecture material and as an assessment of student comprehension for the instructor (Brame, 2013; M. K. Kim et al., 2014). In addition to providing incentive for students to watch the videos, student engagement with the lectures can be increased by improved video production quality, lecture design, and providing a means for students to interact with videos (Brame, 2016; Choe et al., 2019; Mayer, 2008; Mayer & Fiorella, 2014; Mayer & Pilegard, 2014; Prud'homme-Genereux et al., 2017; Smith & Francis, 2022; Szpunar, Jing, & Schacter, 2014). In terms of video production quality and lecture design, it is important to ensure good audio in asynchronous lectures (Smith & Francis, 2022), to highlight key concepts or terms (Mayer, 2008; Mayer & Pilegard, 2014), emphasize the use of figures and animations over text (Choe et al., 2019), provide lecture transcripts and/or closed captions to increase lecture accessibility (Smith & Francis, 2022) and to make sure visuals of the instructor do not overlap lecture material, be that on a physical board or slide (Choe et al., 2019). Interaction with lecture material can be achieved by distributing questions throughout the lecture that students must answer before moving on with the material (Brame, 2016; Szpunar et al., 2014).

Another limitation of student accountability and engagement with course material is the potential for students to become overwhelmed with the sheer volume of content to watch or the complexity of materials presented in asynchronous lectures (Mayer, 2008; Mayer & Pilegard, 2014). This is referred to as "cognitive overloading", and it is imperative to manage the cognitive load that students must deal with in prerecorded lectures (Brame, 2016; Mayer, 2008). One can prevent students from being overwhelmed by the volume of lectures by making short lectures (5–10 minutes (Prud'homme-Genereux et al., 2017) and by spacing out course content, rather than releasing it all at once (Maheshwari, Jain, Ligon, & Thammasitboon, 2021; Smith & Francis, 2022). Addressing the lecture's learning objectives directly (Smith & Francis, 2022), ending lectures with a summary of the material, and embedding mechanisms for students to work through the lecture at their own pace (e.g., using "continue" buttons; Mayer 2008; Mayer and Pilegard 2014)) are ways to manage the complexity of lecture material.

I integrated many of the above techniques in an effort to manage student accountability and engagement with course material in my EARTH 2 class. For example, I released a new set of lectures weekly and did my best to not have individual lectures run longer than ~15 minutes. Each lecture started with what I hoped my students would take away from that video. Key terms were always written in red text on my slides and the majority of slide content was always images and not text. I recorded all my videos wearing headphones with a mic close to my mouth for audio quality purposes and included a video of myself lecturing with (most) of the slides and audio. Most importantly, each set of lectures had an accompanying quiz that I hoped would both incentivize my students to watch the lecture and serve as a self-check on their comprehension of the material.

Despite this, it was clear that my students were not watching and likely not engaging with the asynchronous lectures to the degree that I hoped they would. In a typical week, I observed that maybe half of my ~25 students were watching all the lectures that I had posted (using the statistics provided by GauchoCast). This was despite the fact that the vast majority of students were completing the quizzes associated with the lectures. Although I'm sure much of this was due to pandemic burnout, there are a handful of things I would approach differently if ever tasked with teaching a course entirely online again in the future. First, although quizzes can be a good metric to assess student understanding, it is difficult to write quiz questions for an introductory-level course to which students cannot easily google the answers. I assume that many of my students were doing just that, answering the quiz questions by looking up the answer online, rather than watching the lectures themselves. In the future, asking students to write one-paragraph "lecture reflections", where they discuss what they found interesting or found confusing, as either an alternative or in addition to the short quizzes may be a better way to not only incentivize students to watch asynchronous lectures (V. Guevara, personal communication, January 27, 2022) but such writing may also lead them to be more engaged with the material (Camfield & Land, 2017). Lecture reflections have the added benefit of possibly accessing higher-order Bloom's taxonomy skills, such as applying and analyzing (Bloom et al. 1956; Anderson et al. 2001).

BENEFITS OF ASYNCHRONOUS LECTURES

Despite the challenges that asynchronous lectures pose, they do offer several benefits for students that center on equitable, accessible, and inclusive teaching, or creating a class space that meets all student needs, rather than just privileged and able students (Harris et al., 2020). First, asynchronous lectures provide flexibility for non-traditional students, including commuter students, students who work fulltime while pursuing their college education, and/or students with children or other familial obligations (Harris et al., 2020; Smith & Francis, 2022). This is particularly important in the geosciences, as the diversity among our students has not improved in the last nearly half a century (Bernard & Cooperdock, 2018) and non-traditional students are more likely to identify as first-generation, person of color, or LGBTQ. The predetermined schedule of the traditional, synchronous classroom can leave these students with the difficult decision of missing out on class to go to work or pick a child up from daycare; prerecorded lectures allow these students to attend class whenever is convenient for them.

Second, although some studies suggest that synchronous, in-person lectures are beneficial for students with disabilities (Dahlstrom-Hakki, Alstad, & Banerjee, 2020), asynchronous lectures do provide some additional benefits for disabled students. For example, instructors can, and should, provide captions, image descriptions, and/or a downloadable transcript of the audio from each video (Harris et al., 2020; Smith & Francis, 2022). These additional elements, which are more difficult to provide for synchronous lectures, make lectures more accessible for visually impaired and/or deaf and hard-of-hearing students. In addition, videos allow students to move through the lecture material at their own pace, serving as both a means to manage cognitive load (Mayer & Pilegard, 2014) and a helpful tool for students to learn how to take notes (V. Guevara, personal communication, January 27, 2022). Further, asynchronous lectures could be used as a supplement to or in place of a course textbook, which are more accessible for students who have reading disabilities (Garrison & Vaughan, 2008; Kinsella, Mahon, & Lillis, 2017).

Finally, with proper implementation, asynchronous lectures can moderate whose voices dominate classrooms spaces. Students from underrepresented groups, which in the geosciences includes effectively all students who do not identify as cis-gendered white men (Bernard & Cooperdock, 2018) are less likely to participate in in-class discussion for a variety of reasons (Aguillon et al., 2020; Bravata et al., 2020; Y. K. Kim & Sax, 2009; Ochoa & Pineda, 2008). Moving lectures online and providing a means for students to ask questions anonymously (Smith, Hoare, & Lacey, 2018) may remove some of the discomfort and intimidation students from underrepresented groups feel when they perceive they do not have the language to speak among their white peers (e.g., Ochoa and Pineda 2008) or feel that some students are asking questions for the sake of coming across as intelligent to the instructor (V. Guevara, personal communication, January 27, 2022).

FUTURE USE OF ASYNCHRONOUS LECTURES: THE FLIPPED CLASSROOM

Although I was dissatisfied with student engagement with asynchronous lecture material in my fully online introductory-level course, I could foresee using prerecorded lectures as part of a blended, flipped classroom model for an upper-division course in the future. Here, I define a flipped classroom as one where typical in-classroom activities, such as lectures, take place outside of the classroom, and "homework" type activities take place in the classroom. "Blended" refers to a class in which some of the course material is online (e.g., lectures), and the remainder of course activities take place in person (e.g., discussions, lab exercises). In addition to some of the equitable, accessible, and inclusive teaching benefits discussed above (Smith & Francis, 2022), the flipped classroom model has the added advantage of moving activities focused on high-order Bloom's taxonomy learning objectives (Anderson et al., 2001; Bloom et al., 1956) to the classroom under instructor supervision (Brame, 2013). Importantly, approaching science coursework in this way has been demonstrated to foster critical thinking skills in students (Styers, Van Zandt, & Hayden, 2018), which is a key tenant of my teaching philosophy. Flipped classrooms have been successfully implemented in upper-division geoscience coursework (e.g., Dunkle and Yantz 2020; V. Guevara, personal communication, January 27, 2022) with documented improved learning and positive course attitudes (Dunkle & Yantz, 2020).

However, like using asynchronous lectures in a fully online class, flipped classrooms do not come without their challenges and limitations. These challenges require that flipped courses be carefully and intentionally designed and implemented (Dunkle & Yantz, 2020; Harris et al., 2020). One of the biggest challenges that instructors tend to face in flipped courses is student resistance to an unfamiliar teaching style (Harris et al., 2020; Herreid et al., 2014; Shekhar et al., 2020). Discussing your rationale for choosing a flipped classroom (Harris et al., 2020), providing a means for students to give frequent, anonymous feedback (Dunkle & Yantz, 2020), and being clear about course expectations (Dunkle & Yantz, 2020) may lead students to be less critical of a "non-traditional" approach to learning.

SUMMARY

In summary, using asynchronous lectures as a replacement for synchronous instructions has diverse limitations and benefits. The biggest challenges of prerecorded lectures are getting students to engage with the material and the lack of built-in accountability that in-person lectures provide. However, asynchronous lectures can facilitate a more equitable, accessible, and inclusive classroom. Although I was dissatisfied with student engagement with prerecorded lectures in my introductory-level EARTH 2 course, I can see the potential benefits of using asynchronous lectures as part of a blended, flipped classroom for future upper-division coursework.

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Appendix 10. Syllabus for EARTH 2 (Physical Geology) class taught in summer session A 2020

Physical Geology (EARTH 2)
Summer session A 2020

Instructor: Amy Moser (amoser@ucsb.edu)

Teaching Assistant: Evan Monroe (emonroe@ucsb.edu)

Office hours: I will hold zoom office hours twice per week and Evan will hold zoom office hours once per week. Join us if you have any questions about the course material or Earth science in general. We are happy to chat with you about anything and everything, including what it means to be a geologist. No need to reach out ahead of time if you'd like to join us in our office hours. Just log on at any time and we'll let you in from the waiting room.

Amy: Tuesdays from 3 PM–4 PM, Fridays from 10–11 AM (link here)
Evan: Wednesdays from 11 AM–12 PM (link here)

Contacting your instructors: Please reach out to Evan or I via email or direct message in Nectir if you have any questions or concerns about the course. We genuinely care about your education and are passionate about geology. We want to help you succeed in any way we can!

Course description and objectives: In Physical Geology (EARTH 2), we will embark on an overview of planet Earth. The lectures you watch and assignments you complete will cover many aspects of Earth Science, from the formation of our solar system, to mountain building, the evolution of life, and climate change. In this course, students will:

- Define the most significant features of Earth and describe how different parts of our planet interact from the outmost parts of the atmosphere to Earth's literal core.
- Classify the rocks and minerals Earth is composed of and describe how different rock types form.
- Explain the physical, chemical, and biologic processes (for example plate tectonics, erosion, the evolution of life) that have shaped Earth through time and recognize the results of these processes in the modern landscape.

Textbook and readings: The textbook for the class is *Essentials of Geology* (6th edition) by Stephen Marshak. We will use some of the online guided learning explorations associated with the textbook. The textbook is available both in print and electronically. Whichever type of text you chose, you must have access to the online guided learning explorations. The least expensive option is to "rent" access to the electronic version of the text from the publisher. This will give you access to the electronic textbook and resources for 180 days. If you have a used version of the textbook, it's possible to just buy access to the guided learning explorations. You can find the link to register the code from the print version of your text or purchase electronic access to the text here. Every week I will let you know which chapters in the text correspond to the material I will cover in lecture. The textbook reading is not required, but it is recommended. The textbook should serve to reinforce the topics covered in lecture and as alternative explanation to those I offer in my lecture videos.

Lectures: I will upload prerecorded lectures to the course GauchoSpace page that you can watch whenever is convenient for you, but you should view the lectures by the end of the week (i.e. before Friday night). I plan to cover three topics/chapters from the textbook a week, just as I would have if this class had met in person. Each topic will be broken down into three or four ~10–15-minute videos. In my lecture videos, I will highlight and explain the most significant points covered by your textbook. Watching the lecture videos is essential, as the material I choose to emphasize will give you an idea of the topics you are most likely to see on your quizzes and exams.

Quizzes: Every week there will be three quizzes on GauchoSpace that you need to complete by Friday night at 11:59 PM. Each quiz will correspond to one of the three topics and/or chapters covered in lecture that week and will consist of five multiple choice questions. You will only be allowed one attempt on the quiz, but the quizzes will be open book/note, untimed, and you should be able to go back and forth between questions. The purpose of the quizzes is for you to review your notes once we've finished covering a topic. Every set of lectures will build on the previous topics, so it's important you have a thorough understanding of each set of lectures before continuing. Your lowest two quiz scores will be dropped. The quizzes will cover material discussed in lecture.

Exams: There will be one midterm and one final exam, both administered on GauchoSpace. While technically the exams will be open book/note, there will be a time limit, so it is still important that you study as if it were a closed book/note exam. The midterm exam will be on Friday, July 10th from 4–7 PM and the final exam will be on Friday, July 31st from 4–7 PM. The exams will cover lecture and lab material. The midterm exam will cover the first three weeks of class and the final exam will be cumulative. In weeks that have exams (i.e., weeks 3 and 6) I will only cover two topics/chapters in lecture and there will only be two quizzes and two guided learning exploration exercises. I will also hold live zoom review sessions on the days immediately preceding the exams (Thursday July 9th and Thursday July 30th).

Labs: Each week you will complete a lab assignment that has been adapted for remote/online work. The lab assignments will be related to and reinforce the topics we discuss in lecture. You will complete and submit the labs entirely on GauchoSpace. New labs will be posted to GauchoSpace every Monday and must be completed by Sunday night at 11:59 PM. Your TA, Evan Monroe, will host a live zoom section every Thursday from 2–4 PM, the same time your lab would have been if this course had met in person. Attendance in section is encouraged, as it is a good opportunity to work through the exercise with one of your instructors.

Guided learning explorations: Every chapter of the textbook has an associated "guided learning exploration" that focuses on application questions. I will assign three of these guided learning explorations a week that coincide with the material covered in lecture (two in weeks with exams). These are untimed exercises with unlimited attempts, but each should take you no more than ~30 minutes. The purpose of these exercises is for you to review and engage with the course material outside of the lecture videos. The grades from the guided learning explorations transfer directly to GauchoSpace. Please use the links to the guided learning explorations posted on GauchoSpace to navigate to the online exercises, otherwise your completion/grade will not be recorded.

Seminar: On Wednesdays at noon I will hold a live, 30-minute zoom seminar on various topics in geology that we will not get to cover in class. You will be required to attend two of the six seminars and submit a short summary of each to GauchoSpace, one in the first three weeks of class and one in the second three weeks of class. You will receive 0.25% extra credit on your final course grade for each seminar talk you attend and submit a summary in addition to the required two (e.g. if you attend all six seminar talks, you will receive 1% extra credit on your final grade). You can find the schedule of seminar topics here. Please pick and choose those that you think you will find the most interesting. I hope these seminar talks will expose you to what it means to be a geologist and pique your curiosity on geologic research! They will also be an excellent opportunity for face to face interaction with me and your fellow students. The link to the recurring zoom session can be found here and you can find an explanation of expectations for the summary here. If you choose to attend a talk and write a summary for any given week, the summary should be submitted via GauchoSpace by the following Sunday at 11:59 PM.

Nectir: I have set up two Nectir channels for our class, and a channel for you to post examples of "geology in real life" (link here) and a general questions channel (link here). You can find instructions on how to register for and use Nectir here.

Geology in everyday life: You will be required to post twice in the "geology in real life" channel and respond three times to your fellow students' posts. You should post once in the first three weeks of the class and once in the second three weeks of the class. You may post up to four additional times (once per week) for up to 1% extra credit on your final course grade (i.e. 0.25% for each additional post). I hope this forum will result in an informal social media-esque discussion of geologic news articles, photos, and features you observe in your own life! You can find the complete instructions for the assignment at this link.

General questions: Please use the general questions Nectir channel for any clarifying questions you have on course material or any issues you have accessing the online content. Evan and I will regularly monitor the Nectir chat, and it is your best course of action to get in immediate contact with us.

Please feel free to use Nectir to create your own study groups or a class channel without the instructors if you'd like a space to engage with each other without our ever-present gaze.

Grading: Your final grade in this course will combine your exam, quiz, and lab scores with your completion of the guided learning explorations, posts in the Nectir chat, and seminar summaries. Your grades will regularly be updated on GauchoSpace.

Lab assignments:	25%
Final exam:	25%
Midterm exam:	20%
Quizzes:	10%
Guided learning explorations:	10%
Seminar summaries:	5%
Nectir posts:	5%

UCSB Disabled Students' Program: If you require accommodations for this course, including but not limited to captions in lecture videos or extra time on exams, please reach out to both myself and the Disabled Students Program at http://dsp.sa.ucsb.edu/ as soon as possible so we can make proper and timely arrangements.

Academic dishonesty: If you claim others' work as your own (including but not limited to cheating and plagiarism) you will immediately be dismissed from this class and referred to the administration. You can find the University's policy on academic integrity at this link.

COVID-19: As your instructors, we understand students are facing unprecedented challenges as a result of the COVID-19 pandemic. Please reach out to your instructors if you have internet-connectivity issues or other obligations that are preventing you from properly engaging with the course material. We are reasonable people and are willing to make accommodations if you communicate with us!

Lecture topic schedule

W	Topics	Textbook chapter
1	Introduction and Earth formation	Prelude, Chapter 1
	Plate tectonics 1	Chapter 2
	Plate tectonics 2	Chapter 2
2	Minerals and igneous rocks	Interlude A, Chapter 3, Chapter 4
	Sedimentary rocks, fossils, weathering, erosion, deserts	Interludes B, E, Chapters 6
	Metamorphic rocks and the rock cycle	Chapter 7, Interlude C
3	Deep time and geochronology	Chapter 10
	Earth History	Chapter 11
	No third topic (exam week)	
4	Structural geology	Chapter 9
	Volcanoes	Chapter 5
	Earthquakes and geophysics	Chapter 8, Interlude D
5	Geomorphology (rivers, glaciers)	Chapters 14, 18
	Geomorphology (mass wasting, coastlines, deserts)	Chapters 13, 15, 17
	Earth resources and groundwater	Chapters 12, 16
6	The geology of North America and California	N/A
	Climate	Chapter 19
	No third topic (exam week)	

Seminar topic schedule

Week	Topic	Speaker
1	From New Zealand to Oman: Geologic field work around the world	Amy
2	The Ivrea Zone of the Italian Alps	Amy
3	Snowball Earth	Amy
4	When and how do rocks break? Using geochronology to date earthquakes and other types of deformation.	Amy
5	Evan stuff!	Evan
6	The geology of United States National Parks	Amy

Appendix 11. Assignment instructions provided to students for Nectir "geology in everyday life posts"

Assignment: Geology in everyday life Nectir posts
Physical Geology (Earth 2)
Summer session A 2020

Description

We interact with geology in our daily lives in more ways than most people recognize. While you're surfing at campus point, the ocean is activity working to erode the cliff faces that form the backdrop. Maybe you follow a travel blogger on Instagram who posts spectacular mountain landscapes; those landscapes were sculpted from geologic processes. When you turn on the faucet to wash your hands, the water was likely drawn from underground or above ground resources, but either way that water comes from Earth. For this assignment, you will share these examples of "geology in everyday life" that you encounter while going about your normal day. My hope is that this assignment will help you recognize the multitude of ways geology impacts your lives on a regular basis and start conversations that facilitate interaction among your fellow classmates.

Requirements

To earn full credit for this assignment, you must fulfil two requirements:

1. Post an example of geology in everyday life once in the first three weeks of the session (due Sunday, July 12th at 11:59 PM) and once in the second three weeks of the session (due Sunday, August 2nd at 11:59 PM) in the class "geology in everyday life" Nectir channel (the link to which can be found here). Examples of geology in everyday life that you can share in the channel include a scientific news article about something geologic, a picture or video of a geologic feature you saw while on a hike, visiting a beach, or driving by the side of a hill, a geology social media post you thought was interesting, or anything else geologic you experience while going about your daily life. Your post should consist of the link to the online example or photo/video of the geologic feature you saw plus a ~2–3 sentence summary of the article/post or description of the photo/video.
2. Respond to three of your peer's posts at any time during the session. Your response can be anything from something you found interesting about what they shared or a question you had regarding their post.

Grading and extra credit

These Nectir posts are worth ~5% of your overall grade and will be graded solely on completion (either you do the posts and get the points, or don't do the posts and don't get the points). You will receive 0.25% extra credit on your final course grade *for each additional week* you post an example of geology in everyday life for *up to* 1% total extra credit on your final course grade. For example, you will get 1% of extra credit if you post examples in the channel during all six weeks of the class. However, posting twice in one week will only get you 0.25% extra credit. You will not receive extra credit for additional responses to your peers' posts, but please feel free to comment on as many of the posts as you would like!

Please reach out to me if you have any questions about this assignment.

Example of "geology in everyday life" post

https://www.nasa.gov/feature/ames/ice-confirmed-at-the-moon-s-poles

Here's a short article from NASA that highlights some cool planetary science research published in 2018. NASA built an instrument that in part functioned to detect the presence of water ice (solid H_2O) on the moon's surface, and they found it! It turns out that craters on the moon's North and South poles are cold enough for ice to exist. Planetary geologists are still working on figuring out how the ice got there in the first place. Check it out!

Appendix 12. Example of student interaction in Nectir through "geology in everyday life" posts

Barbara J Fairweather @barbara.j.fairweather 2:39 PM
3-Bumpass-Hell-e-e1477050527613.jpg (603.44 kB)

July 30, 2020

Barbara J Fairweahter @barbara.j.fairweather 2:42 PM
This is a photo of Bumpass Hell in Lassen Park in the Sierra Nevadas. I went earlier in the summer and I wish I got to see it, but the trail was closed because of snow. You can see some of the Thermophilic bacteria giving the surrounding rock a lot of color. Im going back once the final for this class is over to celebrate the start of my actual summer so hopefully the trail is open this time!

August 1, 2020

Visala @visala 8:00 PM
Wow that's a really cool picture! That's super interesting that the thermophilic bacteria give a lot of color to the rock, I didn't know that bacteria could do that. I wonder how they are able to do this?

August 2, 2020

Brianna Karson @brianna.karson 1:11 PM
This is awesome! I was just reading about how different bacteria give the rock different colors because of their differences in temperature tolerance. I hope you get to see it in person this time!

Mary Cadogan @mary.cadogan 5:05 PM
This is really cool, I hope you get to see it soon! I had seen other images of bacteria changing color in the rocks but the water in all of those looked really green in comparison to this one. It is really interesting that bacteria are able to do that!

Gabriel Da Silva @gabriel.da.silva 6:46 PM
This is super awesome. I believe these hot thermal vents were created by magma chambers under the Earth's crust. The sierra nevadas were created by subduction from the farallon plate.

Melina Gharibian @melina.gharibian 10:59 PM
this is super cool! i hope you get to go visit the trail- im sure the snow and water deposits will further enhance the color change and activity of the bacteria. thatd be so interesting to see