Teaching narrative

Introduction (approach to teaching and learning)

Ecology is broadly understood as the study of the interactions between organisms and their environment. This kind of study necessitates a network-like view, imagining an individual, all the connections it makes with other organisms, and the connections it makes with the environment. I bring ecology to my teaching: I want to know about interactions between students, learn more about interactions between me as the instructor and the students, and interactions between students and their coursework. As an instructor, I take a holistic view of the students and class to place material in the context of students' lives as members of the UCSB community.

Across teaching topics and modalities, I am guided by an "ecology of place"[12]. Many ecologists work within one or two very specific study systems that ultimately become their specialty, studying an "ecology of place", or the ecology of a single site or area. Ecological theory is best tested and explored in systems that researchers know well; many foundational concepts in ecology come from scientists who spent decades doing research in one place. I interpret this in the context of teaching to mean that for students, ecology and the environment is best studied in a place that students know well, feel supported in, and are connected to.

Establishing this cultural connection to classroom material is important to me, because I view my own experience as an example of how an ecology of place works in *learning*. I am originally from Santa Barbara (Goleta, specifically), but I never felt at home here until I took EEMB 113L (then Vertebrate Zoology, now Vertebrate Ecology and Evolution). When I took 113L, I learned about birds, reptiles, amphibians, and mammals that we could see on campus and around town. Then, when I took Plant Ecology, I learned about the different plant species that shape the habitats that these animals occur in. And when I took Ecological Restoration, I learned about the then-recently acquired Ocean Meadows Golf course, and how restorationists and stakeholders were working together to achieve seemingly disparate but complementary goals for the open space it would become. I had imagined that "ecology", what I learned about in school, happened in far away places - coral reefs, arctic tundra, and the like - and never imagined that "ecology" could happen in the place I called home.

After learning more about the "ecology" of my "place", I felt more at home in Santa Barbara. In my teaching, I try to bring the classroom to life by making sure that new concepts are grounded in ecology, and specifically ecology of local places. In practice, I work within local sites to conduct field trips and use local examples in lecture and/or discussion to invite students to see themselves and places they know in their coursework. My goal with this work is to make material more accessible to students to bring the material into a setting that students feel familiar with.

In graduate school, I have pursued teaching opportunities at the high school, undergraduate, and graduate level; taught coding, discussion, and field courses; served as teaching assistant, workshop facilitator, and instructor of record. I am specifically passionate about teaching in ecology in two ostensibly disparate but interrelated fields: field ecology and data science. I first imagined field ecology as dominated by people in quick-dry clothing, often with binoculars around their necks, cargo vests, and (honestly) mostly white and old. When I first imagined "Data Science", I imagined "hacking into the mainframe", 1s and 0s flying by in neon green against a black background as a coder sat in a dark

room, furiously typing out lines of code that were incomprehensible. While some of those images are true (I am indeed often coding in the dark, late at night, bleary eyed and disheveled), so many of them are not (to name a few, #BlackinMammology, #BlackinMarineScience, Outdoor Asian, Latino Outdoors are initiatives to show that people of color are active participants in field/outdoor based activities and core members of the community).

When taking a broad view of data science, it starts with getting data and ends with communicating about data (Figure 1).

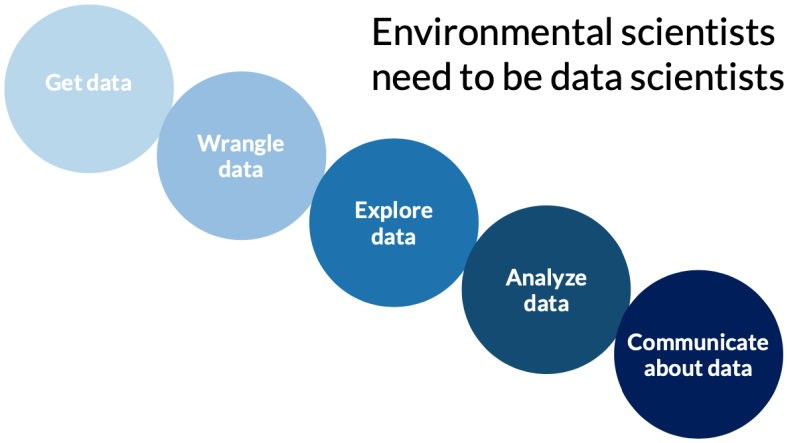

Figure 1. Environmental scientists need to be data scientists! There are steps in "data science" that require different skills along the way, but all these steps should be informed by biology, ecology, environmental science - basically, the realities of the system from which the data is collected. This is a slide from a lecture for Statistics for Environmental Studies that I give on the first day of class, adapted from Dr. Allison Horst.

Both those steps and all the steps in between are informed by ecology and environmental science. Data is ultimately information - numbers or values representing some aspect of a study system. Getting information (i.e. data), wrangling it, exploring it, analyzing it, and communicating about it needs to take place in the context of the ecology: does this information make sense in the context of the study system? Does this visualization reflect expected or surprising patterns in the system? Does our interpretation of that information mean we've learned something new about this system?

In my view, everything in data science should be informed by ecology, and ecology is informed by field study and natural history. Thus, when teaching both those topics, my mind constantly shifts between the two. When I teach students how to take data in the field, I teach them how to do so in a way that if they were to analyze their data, they would find it formatted in a way that would allow them to do it easily. When students are learning how to explore their data, I ask them to go back to their original question about the effects of x (a predictor variable) on y (a response variable) or the differences in y between groups to inform what kind of figure they make. And lastly, when students need to communicate about the data, I always tell them to "go back to the biology": what does this statistical output tell you about the system you are studying? Not only does this approach allow students to become more comfortable with data analysis, but it also helps them be able to

communicate the results of their research more effectively, connecting to one of my main teaching values of modeling and including a variety of communication methods in my teaching.

"Dipping your toes in": short-form field courses build the foundation for student confidence in field ecology

As an undergraduate, my perception of "fieldwork" was that it was done in remote, difficult to access, "pristine" places - all commonly held beliefs shaped by a white supremacist, colonial framing of nature. After taking Vertebrate Ecology and Evolution as a student, I was inspired to pursue a career in ecology after seeing that I could study ecology in places I knew (for example, UCSB campus). I became head teaching assistant for this class in Fall 2017, my first quarter as a graduate student. I rose to the challenge (everyone made it back safely from field trips every day, which was a relief), but I didn't have the confidence to experiment and change. With every subsequent iteration of the class, I was able to change a bit more, with all these little changes eventually shaping a class that is in some respects different from the one I knew as an undergraduate, but hopefully inspires the same wonder in this generation of students.

My first pedagogical experiment was to design a series of assignments that allowed students to explore their surroundings. In a series of assignments that students complete throughout the quarter, they 1) build a foundation in natural history by creating a field guide for a taxonomic group and field site of their choosing, 2) develop scientific inquiry and techniques by designing a study around their species of interest, and 3) create an interpretive sign to communicate why understanding their chosen species and site is valuable, and why their hypothetical study would shed light on the ecology of these species. I designed these assignments to break down the barriers between students and field ecology (e.g. physical distance, cost, inaccessibility) by demonstrating that learning about natural history, study design, and communication can be done well in familiar, local places. After completing these assignments, students understand how their individual perspectives bring valuable insight to ecology, and that their own questions arising from their natural curiosity are worth answering.

Additionally, I wanted to bring more artistic interpretations to natural history. To that end, I borrowed an activity from California Ecology and Conservation (description in the following section) for students to teach each other natural history and create an art piece about their topic. This is akin to a "jigsaw" style activity, where one or two students take the responsibility of learning about a topic to teach others about it, with the end goal of everyone in the class learning about everyone else's topics but only having to do a deep dive into one. Every week, the class visits a new field site; this means that every week, a new set of students is responsible for teaching their peers about either a) the habitats we will encounter or b) 1-2 plant species that define those habitats. Both students also describe the kinds of animals we might see at our field site so that everyone can be on the look out for new species. The most fun part of this activity is that students create an artistic interpretation of their topic, whatever that might be: some students wrote poems, others painted or drew - one student even hand built clay acorns (their plant species was the valley oak, *Quercus lobata*) and gave each classmate their own acorn, and another made "cowboy cologne" out of their plant species, *Artemisia californica*.

Another experiment was to rearrange the course schedule with a growth mindset towards building confidence in the field. Most students who take Vertebrate Ecology and Evolution have not

had any previous field experience. I organized field trips to ramp up in difficulty; week by week, students build on a foundation of basic field skills (e.g. how to use binoculars, field guides, record data) through increasingly more challenging field experiences, ending in data collection for course research projects I designed in collaboration with UCSB professors, reserve directors, and restoration practitioners. For example, the field trip for the first week of class is walking around campus, getting used to using the equipment and writing things down. By the end of the class, students are hiking up hills at Sedgwick Reserve in Santa Ynez, checking an array of coverboards for reptiles and amphibians to answer a research question. By designing a curriculum that becomes more challenging as the quarter progresses, I make sure students end the course with the competence to conduct their own field work. After gaining confidence in their skills as field ecologists in my class, students who previously had no experience with field work have gone on to participate in quarter-long field courses, facilitate field excursions for Black students at UCSB, and pursue graduate school and careers in ecology. Guiding students to experience field work in a way that makes them think about what it would be like to do so as part of their careers is especially meaningful to me, since one of my teaching values is to help students connect coursework to their careers. I aim for students to gain ownership of their work and their trajectory in the classroom in a way that prepares them for their life outside of UCSB.

Lastly, I wanted to experiment with reflection assignments to provide students an opportunity to establish their own learning goals, thus taking ownership over their experience in the class. This breaks down barriers between students and myself as an instructor: instead of seeing me as someone with the authority to make or break their grade, students see themselves as facilitators of their own learning. Students write reflections at the beginning, middle, and end of the quarter to 1) identify their learning goals and how to achieve them, 2) check in with themselves to make any needed adjustments to their work in the class, and 3) assess their own achievement of their learning goals. By completing these reflections, students 1) start the class with a clear vision of the value the course can bring to their own learning, 2) view learning as an iterative process during which assessing progress is key, and 3) evaluate their own learning independently of the grade they receive in the class. Importantly, I encourage students to reflect on points of pride and how far they have come to foster a sense of ownership over their own education. At the end of the class, students are always surprised at how much they learned; many of them note feeling overwhelmed with the volume of material, but most are proud of the work they have accomplished throughout the quarter.

I credit 113L with sparking my curiosity as an ecologist when I was an undergrad, and I try to channel that enthusiasm every time I teach the course. Students pick up on this enthusiasm, writing:

> ... [An] clearly loved the subject she taught, and took passion in both it and learning more about her students. (2019)
>
> "I love that you could see how passionate and knowledgeable she was about all of the vertebrate species when we were on field trips!" (2024)

I will admit that it is easy for me to be excited about anything if I am outside, walking around in the sun, looking through binoculars. However, I know that this is a tough class to be in: 6 hours, half of which is on your feet, walking around, balancing multiple sources of information at once, and taking care of yourself can be very challenging. Students wrote in their evaluations that they wished the course could be split up into two 3-hour chunks instead of having a 6 hour block, which is understandable;

however, given the constraints of the class, that isn't possible. Instead, I try to build in breaks throughout the class period, remind students to drink water, and encourage each student to take individual breaks if they are feeling tired. This class is certainly a marathon, but I hope my enthusiasm and excitement in the field translate to students as they move through the course.

"Taking a deep dive": long-form (residential) field courses provide immersive research experiences

After teaching 113L for many quarters, I knew I wanted to teach field ecology after graduate school. However, I had never taught a long-form (i.e. residential) field course; taking students out on overnight trips is a much more emotionally and labor intensive endeavor. In Fall 2023, I pursued the opportunity to be the teaching assistant for California Ecology and Conservation (CEC), a 7-week long course where students design and execute research projects at different sites in the UC Natural Reserve System (NRS). I loved my experience so much that I supported the class again in Summer 2024, and I feel very grateful to have had the chance to work with CEC twice.

I love the NRS, and visit many of the sites managed by UCSB in 113L (e.g. Coal Oil Point, Carpinteria Salt Marsh, and Sedgwick), so I was really excited to join the class. Additionally, I was excited to learn more about mentoring student research. 113L provided a rich opportunity to explore natural history, but I hadn't mentored students in developing a research question, articulating hypotheses, or designing experiments before. This seemed like the logical next step after learning about the natural history of a place, so I was excited to see what this process was like.

The "ecology of place" is in full force in this class, because students spend the first couple days at a reserve learning about the natural history and past research that had been done there before proposing their own research projects. Natural history days were my favorite days of the course, because I got to see what students picked up on when identifying plants and animals. Additionally, natural history days introduced me to the "meet a plant" exercise, which I implemented in 113L upon my return to UCSB; students spent time with a plant, observing it and any species interacting with it, then described how to identify it and created an artistic representation of the plant, whether it was a poem, song, game, painting, or anything else.

There are so many things that make teaching long-form field courses different from short-form field courses that it's difficult to choose one (or even a few) things to highlight. The first thing that comes to mind is the fact that support staff - instructors and course assistants alike - are living *with* the students. While we have separate living quarters, we eat meals and share common spaces with students. This means that protecting one's own boundaries becomes crucial for making through the course. When I taught the course in Fall 2023, I felt I had to be there for students all the time; for example, if they were working on final papers late into the evening after dinner, I would be in the common room to answer any questions until the deadline at 10 PM. The instructors made a more structural change by the time I joined the class again in Summer 2024 so that each instructor had "office hours" during which they were available for help, and outside of those times students had to either puzzle things out on their own or wait for the next available time slot. This made teaching in 2024 much more tenable, because there was structure in place for me to provide focused, direct feedback during times I allocated to the students, and I didn't feel my own pressure to be available at all times.

CEC was also a surprising challenge because it involved teaching life skills in addition to ecology and conservation. Days on the course varied in structure; some days - like natural history day - had activities scheduled hour by hour, while research days were free for students to do what they needed to do for their projects. However, breakfast, dinner, and chore time were always at the same time every day, which was challenging for students used to a more relaxed schedule. There were often growing pains at the beginning with students getting used to camping, being warm enough at night, and getting enough to eat. Additionally, on travel days - days we would move from one reserve to another - students had to be organized enough to pack up their belongings, come to breakfast, and be ready to help clean up (a required task at all reserves upon departure) so that we could leave at a reasonable time. Mobilizing students was a large part of my job, so this was one of many surprising aspects of a long-form field course: I was teaching students how to be efficient in life, not only in research. During our daily announcements, I was in charge of assigning students chores for travel days and sharing the chore schedule; on travel days, I supervised students as they were completing their chores and pitched in where teams needed help. In Summer 2024, I started telling students to pack their belongings before breakfast (as opposed to waiting until later in the morning), and that was a surprisingly effective reminder: students came to breakfast with their tent, sleeping bag, and duffel ready to go into the vans. Some students already had the skills to "be efficient" on their own, but others came into the course very green and came out of it with more skills than just research. I recall one student remarking that he had never been camping before CEC, and wanted to keep doing it afterward even though it was really tough for him because he had such a good time. This is the kind of work that I think is important in teaching field ecology, but I find hard to articulate: field ecology can be enjoyable, but you need to make sure that you're comfortable, and being comfortable means that you have slept well, can thermoregulate, and have enough food and water, and all of these things mean that you have to be able to plan ahead and think about what you need to be comfortable. Thus, an ability to plan ahead = a greater chance of enjoying learning about field ecology.

Teaching CEC was my deepest dive into managing interpersonal conflicts in group projects. Students were placed into research projects based on interest, but this placement was done anonymously (it was not impossible to game the system, but most students listed their interests without considering what their friends might put down). Sharing interests with group members does not necessarily lead to good communication about project goals and progress, so this was my first hint that long-form field courses are different from what I had experienced: much of my work was managing group dynamics. This was a really surprising challenge, and I had only dealt with this once or twice, often with the help of a professor. However, I had seen how mediation could work when I was on the ad-hoc DEI committee in my department, and I saw the mediators support graduate students when they were expressing their frustrations with the administration. This experience was especially helpful for me because it allowed me to grow as an inclusive and equitable educator, and to put the values of diversity, equity, and inclusion as they intersect with teaching (please see my *Diversity Statement* for details). From this experience, I learned that listening and "mirroring back" students' feelings was crucial to communicate that I supported them and would advocate for their needs, and we could come up with a solution so that the students would feel they had a path forward in working with their team members. I also advocated for students with the instructors, making sure the teaching team

was all on board about how we could best support students who were struggling. One student wrote in their evaluation that:

> When I was struggling as a student with teamwork dynamics, demonstrated absolute time energy and empathy for the situation. (2024)

I felt as green as the students in managing these kinds of relationships, but I was heartened to read this evaluation. There is space for me to improve to mediate between students when working in groups, but I am glad that this work had an impact in some small way. I wanted students to come out of the class with the skills to advocate for themselves when working with others, and this evaluation makes me think that was possible.

"In the weeds": statistics and communication can draw out a story from data

Quantitative methods and data science are invaluable tools to understand the complexity of the ecological world. However, the math and technical skill that stereotypically define modern data science can be intimidating, forming barriers to student success. I would not describe myself as an especially skilled mathematician; I struggled in high school with calculus, and barely made it through linear algebra in college. That was my last experience with math until graduate school, when I found myself in possession of data and had no idea what to do with it. I also had no idea how to use R, and was *very* worried about having to start in order to analyze my data. That is, until I took Dr. Allison Horst's Environmental Data Analysis class (ESM 206). All of a sudden, data science and statistics were interesting and, dare I say, exciting. I learned that data can tell a story, and it's up to the researcher to provide its "voice" (Figure 2).

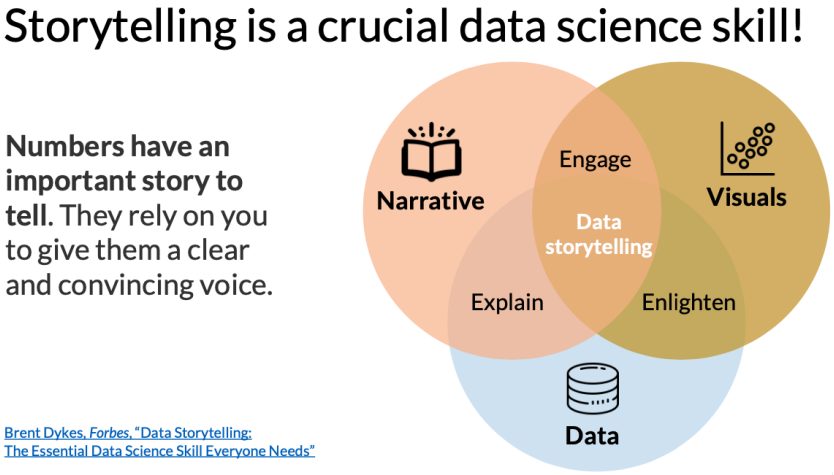

Figure 2. Storytelling is a crucial data science skill! I really like this quote from Brent Dykes' essay about data visualization, and use it to frame what we do in class. I communicate to students that the "clear and convincing voice" comes from them and their unique experiences that inform how they look at and think about data. This is a slide from a lecture for Statistics for Environmental Studies that I give on the first day of class.

Taking Environmental Data Analysis also introduced me to peer learning communities like R-Ladies Santa Barbara and Eco-Data-Science; I really valued the opportunity to learn from peers and teach directed topics. Dr. Horst also reminded everyone in R-Ladies that it didn't matter if you didn't

have expertise in a topic; the best way to learn about something is to teach others to do it. After my first workshop (led with my dear friend and collaborator Sam Csik), I was hooked on teaching quantitative methods and data science. I was the TA for Ecological Modeling for 3 quarters, teaching students how to implement differential equations in R. I taught workshops for Eco-Data-Science, R-Ladies, and my own department on niche topics relevant to ecologists (community analysis, data visualization).

My biggest challenge teaching data science was when I served as Instructor of Record for Statistics for Environmental Studies, a 4-unit upper division course that fulfills the quantitative requirement for the Environmental Studies major. This class did not exist before I started in Spring 2023, so I was building everything from scratch. At first, I was excited about the opportunity; that excitement then turned to disbelief: how could anyone trust *me* to teach statistics? I thought I barely knew anything, but from support from my colleagues and mentors I felt the confidence to approach this class to design the course I wish I had taken as an undergraduate.

One thing that has stuck with me in the years since I took Environmental Data Analysis is that successful data science requires critical thinking. As Dr. Horst put it, "bring your brain to the party." I try to impart this to my students when teaching all the steps/skills within data science (Figure 1). So much of data science is a puzzle: you have to understand how the pieces fit together, the order in which to do tasks, and how to make sense of the bigger picture. This requires critical thinking at every step, from the minutiae of organization (e.g. where are my files on my computer?) to the big interpretation of the data (e.g. what new thing have we learned from our data?). This philosophy has led me to think that I am not just teaching data science, but rather how to "think like a scientist": ask a question, answer it, and follow the thread to the next question. "Thinking like a scientist" is a core value of my pedagogy (please see my *Teaching philosophy statement* for details), and it was exciting to put it into practice. Students picked up on this, writing in evaluations:

> I thought that the assignments were challenging, but they allowed me to become more confident in coding and my problem–solving skills. (2024)

In my time analyzing my own data, I've also been struck by the use of effective data visualization. Realistically, no one cares about the numbers in a spreadsheet until they are translated into a graph that reveals patterns you couldn't see if you were just looking directly at the data. To demonstrate the importance of visual modes of communication, I include data visualization alongside statistical results in every lesson (Figure 3).

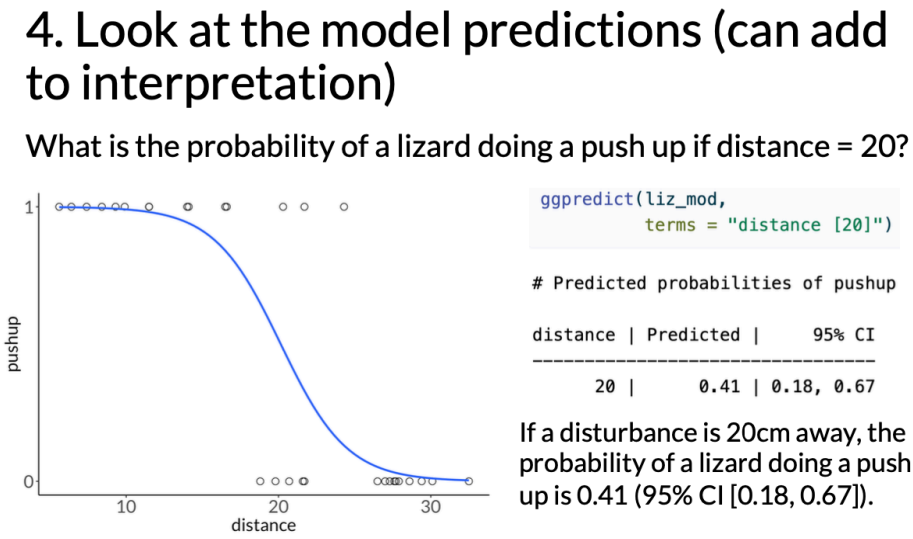

Figure 3. Example of data visualization paired with statistical output. Students interpret the output on the right in the context of the visualization on the left, and vice versa. This is a slide from my Statistics for Environmental Studies class from week 10.

This serves a couple purposes. First, students are able to see that statistical tests can be visualized (left side of Figure 3), instead of just a bunch of numbers. Second, students can gut check their understanding of the statistical output (right side of Figure 3). In this scenario (that I made up for lecture), the research question is about lizard behavior when being disturbed: what is the distance that a disturbance has to happen for a lizard to do a pushup display? I then teach students the appropriate analysis to answer this question (a generalized linear model with a binomial error distribution), visualize the output (with an S-shaped curve), then provide some numbers (the probability of a lizard doing a push up if the disturbance is 20cm away).

Visualization is also *fun*. Visualizing data is my favorite part of working with it, and I try to bring that to my teaching too. For the first coding workshop in the class, I walk students through all the steps they need to create a visualization. For many students, this is the first time they have ever opened RStudio, which can be intimidating. I walk through each step of the code to ease them into the environment, ending with a visualization that they can interpret. I then show them the fun part of visualizing data: changing the colors. I do this to get students to a point where they can think of coding as a tool to get a figure, which they can then use to describe patterns.

I also think visualization is a subversive way of getting students to learn the skills of data science (Figure 1) without talking about it explicitly. “Make a visualization” to communicate about data is a surprisingly complex task: you need to be able to analyze the data (or at least know what you are comparing in the dataset), but before analyzing you need to explore the data so that you know what the variables are and how they relate to each other, but before *that* you need to wrangle (i.e. clean) the data so that it’s in the right format for exploring, but before *that* you need to actually get the data, which means that you need to know what the question and hypothesis are. So, if the final task is to make a figure, students actually have to go through all the steps prior to making said figure that will culminate in a final product (the visualization) that actually demonstrates their competency in those skills: if any

part goes wrong, the figure will not look right. Then the puzzle analogy comes back in, and they have to puzzle their way through figuring out exactly what part went wrong.

Students also reflected positively on making visualizations, writing:

> I think the work I am most proud of that came out of this class was my advanced data visualization. I had a lot of fun making it, and I put a lot of time and effort into turning the idea I had in my head into a graphed figure that told a story in a digestible way. (Reflection assignment, Spring 2024)
>
> When I was compiling my previous visualizations for my Quarto website, I was impressed with how I've progressed. I remember spending so long on my first visualization trying to figure out how to change the colors of my graph. At the end, I was not only able to change the colors and order of everything, but also assess my data and try to work around its biases. (Reflection assignment, Spring 2024)
>
> I'm also really proud of the skills I developed to be able to effectively communicate statistical analysis results, plots, and captions. I think this is a really important skill in effective communication in the science world. (Reflection assignment, Spring 2024)

These reflections are *so exciting* to me! This suggests that students respond positively to data visualization and are excited about it, but also are thinking very critically about telling a story with their visualizations and carefully evaluating their data. These are the kinds of lessons I want students to take away from my class, so this is encouraging to keep doing this kind of work in the future.

<u>Growth in teaching (ESCI analysis)</u>

In my Student Evaluation Analysis portion of the portfolio, I offer a holistic view of my evaluations and growth that encompasses both my work as a TA and as an Associate. I offer graphs that combine findings from both experiences and specify which are related to TAing and which to my time as an Associate. I also infused my narrative with many examples of student evaluations that touch in different ways on many aspects of my growth as an instructor that I focus on in this portion of the portfolio.

For nearly every quarter that I have been enrolled as a graduate student at UCSB, I have taught a course. I have grown a lot since I first started (Figure 4), but not without bumps along the way.

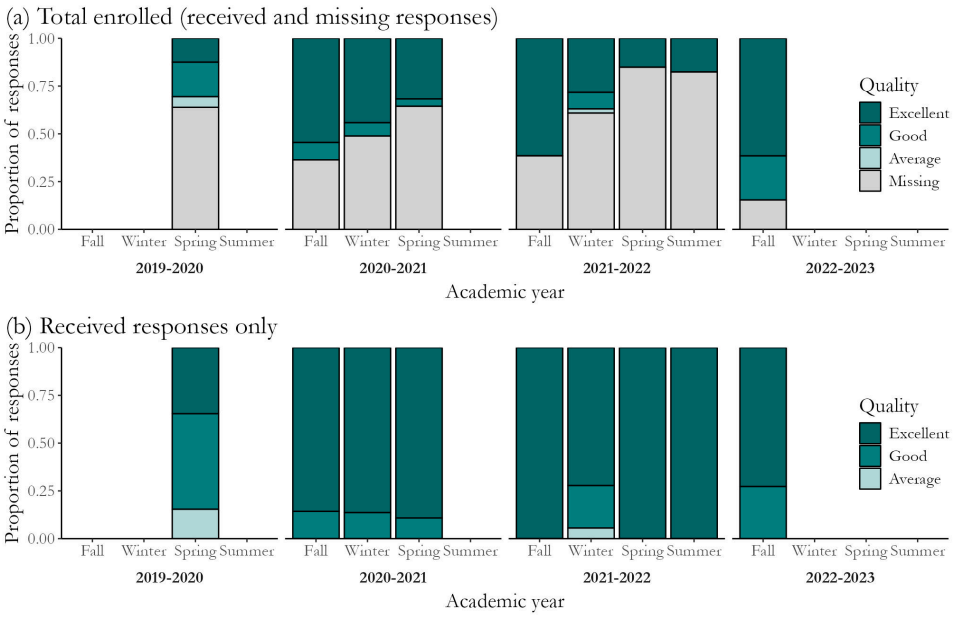

Figure 4. Responses to "Please rate the overall effectiveness of this TA, with respect to attitude, competence, availability, grading and similar factors." Panel (a) depicts proportion of responses including missing responses, and panel (b) depicts proportion of responses in each quality within received responses only.

When I first started teaching, I viewed my role as an instructor as one in which I needed to be punitive; otherwise, where would my authority come from? I eventually realized that I could be an authority in the classroom simply by showing how passionate and knowledgeable I was about the material, and without "punishing" students (e.g. by grading harshly for no reason). I also started to observe instructors I looked up to, and tried to emulate their teaching and mentoring style, which eventually led me to understand that teaching is a conversation between the instructor and students, not a one-way interaction in which the instructor spews information out and the students soak it up like sponges. I see this in my evaluations in later years, as students wrote:

> An did just the right amount of explaining, then asking for students inputs. (TA, EEMB 120, 2022)
>
> Whenever I had more complex questions, An would walk me through all of the information I had and what information I needed and empowered me to come up with solutions myself. (TA, CEC, 2023)
>
> Rather than giving an answer, she asks all the right questions to help us come to our own conclusion, showing us the process of scientific thought. (TA, CEC, 2023)
>
> She's really good at asking the right questions to understand what part of a concept you don't understand, and walking you through the concept from that point by guiding you through the right thought process. (Associate, ENVS 193DS, 2024)

These are reflections of the kinds of conversations I try to have with students when they ask me questions: I try to understand where their confusion comes from, diagnose *why* they are feeling

confused, then walk them to the right answer. Usually, they arrive at the answer themselves without me having to explicitly answer their question, which I hope (and have evidence for, in these evaluations) feels empowering.

I learned that another source of authority could be transparency, in particular in admitting where the gaps were in my knowledge. Early on, I got evaluations as as a TA about how I answered questions I didn't know:

> If you don't know the answer to a question, say you don't know. Oftentimes somebody will ask you a question and you guess/hypothesize an answer. (TA, EEMB 120, Spring 2018)
> When confused about a topic, it could be best just to say that you need to look up/find the answer, so that the class can move on to other topics that needed to be covered. (TA, ESM 201, Winter 2019)
> When someone asks a tough question, don't let the class get out of control. (TA, ESM 201, Winter 2019)
> I felt like a lot of explanations were roundabout and not super helpful. I understand not giving the answer away to students, but more prompted or directed explanations would make me feel like going to office hours is useful. (TA, EEMB 179, Winter 2020)

I took this to heart and taught carefully about why my first inclination when presented with a question for which I didn't know the answer was to start speculating wildly. As part of my "authority" in the classroom, I thought I had to know the answers to everything. Eventually, I realized this was unreasonable, and these evaluations led me to take the approach of saying I didn't know but would follow up later (and importantly, actually following up). I could then see this change from my evaluations:

> I liked that if An didn't immediately know the answer to a question in lab, she would be honest and say she doesn't know, but that she'll make a note about it and get back to us later. (TA, EEMB 179, Winter 2021)
> Answering questions thoroughly and looking up more info if she didn't have the answer right away. (TA, EEMB 179, Winter 2022)

After I started being honest with students about not knowing something and following up with an answer, I felt like I was having a conversation with them about knowledge: they would ask me a question, my response would be that I didn't know, but then the conversation would continue when I followed up with the information I had learned.

Additionally, I received evaluations that prompted me to think of ways to continue the conversation when leading discussions. For example, an early evaluation stated:

> During long pauses of nobody answering, maybe stimulate conversation or hint towards the answer. (TA, EEMB 120, Spring 2019)

I took this to heart but also reminded myself that as the instructor, your perception of time is warped: long pauses always feel longer to you than the students. But I thought I could improve with the way questions were worded; for example, if a question was very long (e.g. how do scavenger communities differ across climate zones, and why might that be the case?) then I could break up the question into smaller chunks (e.g. how do scavenger communities differ across climate zones? → What species are

different between climate zones?, why might that be the case? → what characteristics of those species best fit a cold or warm climate?). This proved effective, because in following years students wrote:

> She … was great at breaking awkward silences by asking followup questions or by clarifying the question that she had asked. (TA, EEMB 120, Spring 2021)
> She was able to rephrase questions effectively (TA, EEMB 120, Spring 2021)

Once I started asking follow up questions, I started building the conversation in the classroom, breaking up tough concepts into smaller parts so that each answer would lead to the next question.

I also received evaluations that reflect the kind of teacher I want to be. First, I want to make sure that students feel like the classroom is a safe space to get things wrong *and* to get better:

> She made a safe space to get answers wrong and open up discussions about some difficult to understand concepts. (TA, EEMB 120, Spring 2021)
> She answered questions without judgement, and I felt like she really cared about the students' wellbeing. (TA, EEMB 179, Winter 2022)
> An never made me feel stupid for not understanding something, or not picking things up as quickly as others… An operated in a way that was always supportive and never made me feel like I was dumb for not understanding. (TA, CEC, Fall 2023)

These evaluations are encouraging because I feel students are able to ask questions, get things wrong, and learn from my feedback. This suggests that they are resilient: they can bounce back from critical feedback or corrections and improve their understanding or work. Additionally, I also want to have the skill of explaining concepts in multiple ways from multiple perspectives so that students can understand:

> She … does her best to explain it in a way each of us can understand. (TA, EEMB 113L, Fall 2019)
> She also does a great job of involving everyone and making sure that each student is understanding what they're doing and able to follow along. (TA, EEMB 179, Winter 2022)

There is no one size fits all explanation for a question, and each person might need an answer that is unique to them. These comments suggest that I've been able to see students' perspectives when asking questions, and speak to that perspective when answering. I definitely want to continue doing this in the future.

References

12. *The Ecology of Place: Contributions of Place-Based Research to Ecological Understanding*. (University of Chicago Press, Chicago, IL, 2011).

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