The Aggie Brickyard

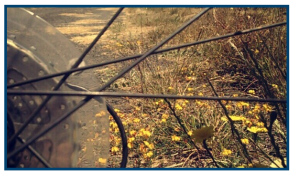
assembling the blocks of ecology at UC Davis

SUMMER 2017 VOL. V

Editorials

TEACHING

FROM THE FIELD
BEES



STUDENT PERSPECTIVES
TA? GUEST LECTURE?

COMMUNITY
DIVERSITY, TEACHING & OPINIONS

SUMMER

South Lake Tahoe at sunset - Ryan Peek

✦ COVER: *Marbled godwits and willets take flight during high tide at Arrowhead Marsh, Oakland, CA. - **Erik Grijalva***

Letter from the Editors

"Ultimately we are all teaching each other, and the best teachers are the ones that learn from the students they teach."

Thanks for patiently awaiting our Spring (but really Summer) issue. In between field work bouts, conference travel, and catching up on the backlog of work from the academic year, there is a moment to take a breath and reflect. Why are we here (not in the philosophical sense, that's probably a conversation better had with a beer)? Why did we come to graduate school? We came because we wanted to learn more about our various study systems or subjects. We came because a great undergraduate professor inspired us to keep going. We came because we thought it might help move us along some career trajectory. Whatever the reason, it is likely that teaching played (or plays) a role somewhere along that road. But, what makes a good teacher? Good question. That strange brew of training, practice, incentives, and humility is something we're hoping to begin to tackle this issue.

We do not pretend to be able to cover the vast ground encompassed by teaching in a single issue of The Brickyard (there are entire doctoral programs for that), but we thought we'd start with a few big questions. What makes a good teacher? How do you get experience (and credit) for teaching? How do you make the most out of your experience? How does the GGE incentivize (or not) quality teaching? A few things seem clear. First, teaching is hard. After all, it's one thing to know your subject matter, it's another to be able to convey it coherently to students. Second, you are likely to fail repeatedly, but you can learn a lot from those failures if you're paying attention. Finally, even if you're good at it, there can be institutional obstacles and professional trade-offs that prevent you from continuing to hone your craft. Nobody knew teaching could be so complicated. Luckily, your fellow students and faculty have graciously provided some ideas for tackling these sticky issues.

As graduate students are often caught between trying to balance coursework, conduct research, attend seminars, teach an undergraduate course on an unfamiliar topic, read an abundance of literature, and have a life outside of school, it is understandable when teaching becomes simply another priority to juggle. However, as many of the letters and articles in this issue can attest, it can also be very rewarding. For many, it is where we learn the most. Hopefully there is content within these pages that you may find useful, or that may inspire you. Or perhaps it will at minimum help you manage your responsibilities more efficiently and reduce the time vested in preparing your next lecture. Ultimately we are all teaching each other, and the best teachers are the ones that learn from the students they teach. They adapt, they listen, and they engage us in a story. Enthusiasm goes a long ways towards motivating an audience, as does the ability to tell a story in pieces we can all understand.

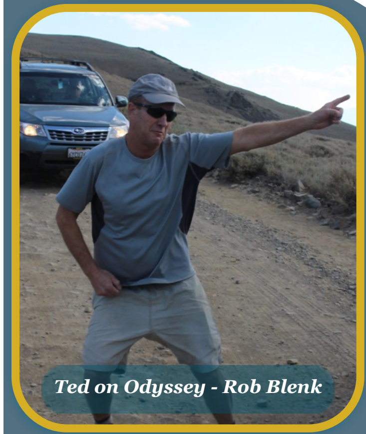
We hope you enjoy this issue of the Aggie Brickyard, and we thank everyone who helped contribute content.

Sincerely,

Your Aggie Brickyard Editors

CHAIR-ISHED REFLECTIONS

A Ted-itorial (*Ted Grosholz*)



"Among the largest obstacles to improving graduate student education are a constellation of University policies that create disincentives for offering graduate courses" - T. Grosholz, GGE Chair

Chair-ished Reflections

Greetings GGE Brickyard readers,

As we approach the Ides of June and the summer solstice soon thereafter, I am providing some thoughts and guidance about teaching and class offerings in the GGE in response to questions posed by the Brickyard editors. As previously stated, my views are certainly my own and do not represent the GGE. However, they are meant to inspire further thought and discussion on this issue.

Should quality teaching be a priority for an R1 research university and how could current teaching in the GGE be improved?

An internationally ranked program like the GGE should provide all aspects of the training needed to turn the 'postgrads' that enter our program into full-fledged colleagues who can contend for a range of highly competitive jobs on the international stage. I want to point out that course offerings and research training are only part of a broader training process. That training also includes improving oral, written and digital presentation skills to be able to better communicate scientific results to multiple audiences, learning to supervise and mentor younger students, and acquiring an understanding of how to interact and conduct research with collaborators (e.g., defining expectations about sharing results and publications, developing professional networks, or developing attribution protocols). Here I focus on course offerings as a key part of this overall training.

Quality teaching at the graduate level should be a priority for a top-flight graduate program at an R1 research university like UC Davis. Admittedly there are limitations to the course offerings available to graduate students in the GGE and we are working to try to improve current offerings. I think we already have some aspects of course offerings pretty well in hand. For example, the GGE core course provides a solid basis of ecological fundamentals across a breadth of sub-disciplines. Also, each of the AOEs has developed a single core course or set of options that provide more specific training in particular areas. Our approach to graduate seminars through the 290 offerings allows students and faculty to discuss more current, cutting-edge issues. What we are lacking, I think, is a more coherent and comprehensive curriculum that would involve a greater selection of ECL graduate-level courses. I address some of the challenges and evolving solutions to solving this problem in the current climate at UCD regarding graduate education.

What are the challenges for incentivizing graduate teaching in the GGE?

Among the largest obstacles to improving graduate student education are a constellation of University policies that create disincentives for offering graduate courses. First, faculty do not receive any teaching credit for graduate student courses, nor does the department receive any credit for student credit hours when offering these courses. Unlike undergraduate courses, departments do not receive funding for each student credit hour associated with graduate courses. Moreover, the faculty do not receive professional credit for teaching graduate courses which significantly affects advancement opportunities during the tenure process. The negative consequences for the department and its faculty members leads some department chairs to actively discourage plans for teaching graduate courses.

Chair-ished Reflections

Yes, of course faculty should want to provide the training needed particularly for the students in their labs. Students certainly contribute substantially to the research program of their faculty mentors, some more directly than others. Also, an important part of the faculty research career involves training graduate students for many reasons. But time is limited, and time teaching courses above the normal teaching load takes away time from research and research training. Given these current challenges, it is difficult for most faculty to add significantly to their own undergraduate teaching load by adding graduate level courses to their teaching responsibilities.

The good news is that there are plans afoot to change the incentives for graduate teaching over the next few years. Our Office of Graduate Studies is making a strong case to the University to change the 'budget model' to allow credit for graduate education for both faculty members and their departments. We can't plan for this next year, but we are expecting this will significantly change the equation soon and facilitate considerably more faculty participation in graduate education in the future.

What is the GGE doing to increase the quality and quantity of course offerings?

Given this current university-wide budget model, it is challenging to find faculty who are willing to add significantly to their current teaching load. We have been investigating some new avenues for increasing our teaching capacity and the courses that would be available to GGE students. One pathway forward, at least for a subset of classes, is to link graduate classes with listed undergraduate classes. This is already being done with a few classes like the core course for the Ecotoxicology/Physiological Ecology AOE. In this case, graduate students sign up for the undergrad class, but there is an additional section added for graduate students to facilitate more comprehensive and in-depth discussion.

Another option we are trying to implement more widely across campus is encouraging greater participation by Cooperative Extension faculty and other Academic Federation members through changes to existing Lecturer job titles. We have a number of GGE faculty who are Academic Federation members without a teaching requirement; this option would allow them to get GGE service credit for teaching ECL courses and also increase GGE course offerings. There is also current planning underway for a Designated Emphasis in Cooperative Extension to facilitate training and future job opportunities in this area. We are also looking to tap the expanding UC Davis Data Science Initiative and their new faculty hires to help permanently staff an R Carpentry course for GGE students, which has become one of the most important needs in the GGE curriculum. Finally, Professors Harrison and Holyoak are rewriting the GGE core courses 200A and 200B for this coming year to more accurately reflect student needs and better balance the course demands for both continuity and diversity of expertise.

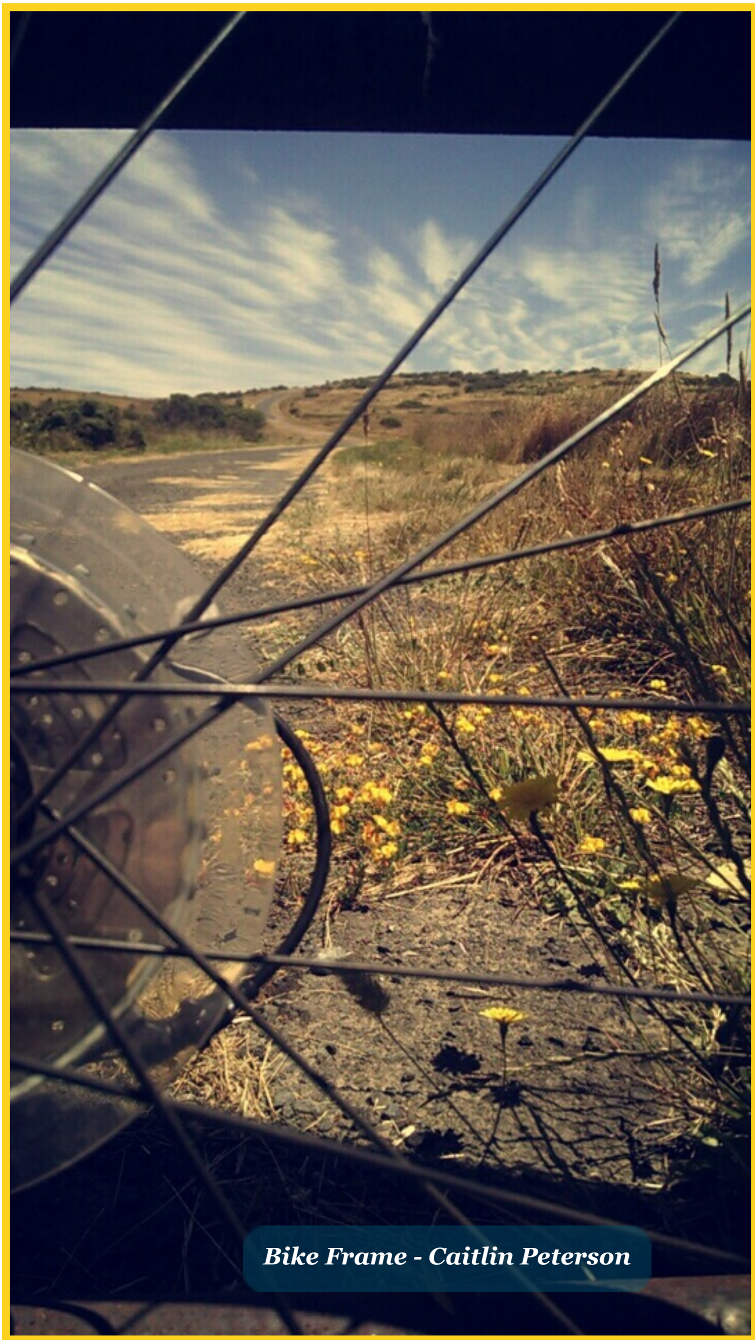
What is your vision for achieving both quality course offering and cutting-edge research training in the GGE, and how can the graduate student community contribute to these goals?

I believe that both quality courses and cutting-edge research are necessary components of a highly competitive and productive program like the GGE and that we can continue to achieve both goals. With regard to course offerings, my current vision depends to some degree on the evolving university attitudes towards graduate education discussed above. If graduate course offerings can be accorded the same or similar credit as undergraduate courses and be considered as part of normal faculty teaching load, this would obviously provide a huge incentive for faculty to expand graduate course offerings.

Even if this restructuring of incentives for graduate teaching doesn't happen quickly, there are ways in which we can move forward to improve course offerings in the future as I have discussed in the paragraphs above. There will always be a trade-off between hours spent teaching and hours spent conducting research and other activities. The ugly truth is the top priority for faculty is their own career above all else, including the success of their students. There is certainly some amount of ethological 'parent-offspring' conflict that is an unavoidable part of faculty-student dynamics that all students need to keep in mind.

Chair-ished Reflections

Lastly, there certainly are ways that graduate students can take some of the education process into their own hands and organize learning opportunities and create some of their own learning environments. Groups like the GGE Graduate Student Peer Mentorship Program and the Davis R Users Group (D-RUG) are some of the best examples of graduate students taking charge of key elements of the learning process and mentoring other students in the program. Also, it is comparatively easy for students to get faculty participation in 290s (a modest time investment), which allows students to fill gaps in the course curriculum. Clearly 290s are not a replacement for an in depth lecture course, but they are among the best options for engaging faculty participation and creating additional curricula given the current environment.



Bike Frame - Caitlin Peterson

Faculty Q & A

On teaching

Louie Yang

Formal teaching-training opportunities for graduate students are pretty limited, how did you prepare to become a teacher? What might you suggest for current grad students?


L. Yang - UC Davis

This sounds a little silly, but I actually think I learned a lot about teaching from my undergrad days as a rock climbing instructor and backpacking guide for Cornell Outdoor Education. I was an undergrad teaching other undergrads, but the program gave us a lot of training and encouraged us to develop fun and creative lessons. (I later figured out that the program coordinators put as much work into educating the "instructors" as they did to educating the "students.") They put novice instructors in teams with more experienced instructors, gave us a lot of latitude to develop our courses, and encouraged us to try out new ideas in the classroom and in the field. This inevitably led to some lessons that were flops, but it also let us develop an instinct for what would work with a class in a fairly low-stress environment. We learned to be prepared and organized, to communicate with students and our teaching team, and to use cautious judgement when the stakes were high (i.e. safety issues). However, we also learned to take pedagogical risks in the classroom, and to learn from our experience as instructors.

In grad school, I had an opportunity to TA a number of courses with excellent instructors. I have tried to assimilate many aspects of these courses into my own teaching, whether it was course structure, lecture style, or a few key examples. I also feel like I learned a lot from leading discussion sections; while you don't get credit as the instructor of record when you are a TA, these sections give you a chance to practice being at the front of a classroom, which is big part of teaching.

I was also really fortunate to participate in the Chancellor's Teaching Fellowship as a grad student, which let me co-teach General Ecology (ESP 100) with Andy Sih. Andy is a masterful instructor, and I certainly learned a lot from watching him up close. I also got a chance to develop my own lecture materials for half of the lectures in this class, which was a new and tremendously useful experience for me. It was a lot of work.

When I started as faculty, I spent some time reading books about course design and tiny little bit of the education literature. I started to develop some ideas that I could assemble into a personal teaching philosophy, which I try to use as a guide when I am faced with decisions of course design and structure. In particular, I've also come to appreciate the value of the syllabus for communicating the course design and goals.

For current grad students, I guess I'd suggest trying to get as much real teaching experience as you can manage. Look for TAships that can teach you something, not just pay the bills. Look for other opportunities to expand the scope of your teaching responsibilities. If you can get a position co-teaching with a more experienced instructor, or if you can find a position as the instructor of record for course that you develop, you can be sure that it will be very time-consuming, but also very rewarding.

Faculty Q & A

Louie Yang (cont.)

Many GGE students will eventually face teaching their first course, how did you prepare for your first full course?

I spent a lot of time developing the syllabus and course goals the first year, and tried to create lectures for as much of the course as possible ahead of time. It still felt like an overwhelming amount of work that first year, with very little time between classes to prepare for the next lecture. I tried out several ideas in my first year that I have since revised or discarded completely, but I'm glad I tried them, and hope I don't become too cautious to try out new ideas in my classes, even if some of them flop. It is hard to know ahead of time if an idea will work. I definitely had some days that I felt good about, and others that I didn't; the important thing seems to be your willingness to continue trying to improve.

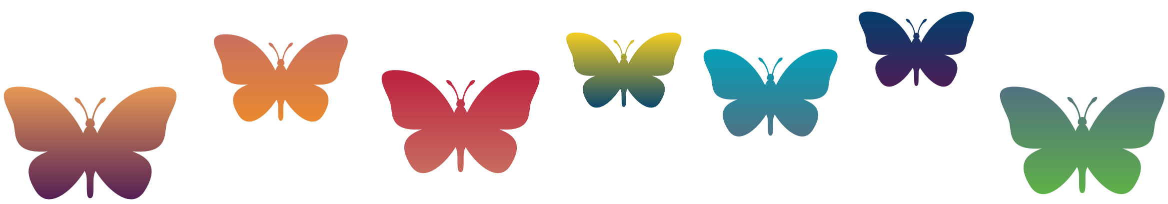
Does any part of teaching make you nervous? Or feel especially rewarding?

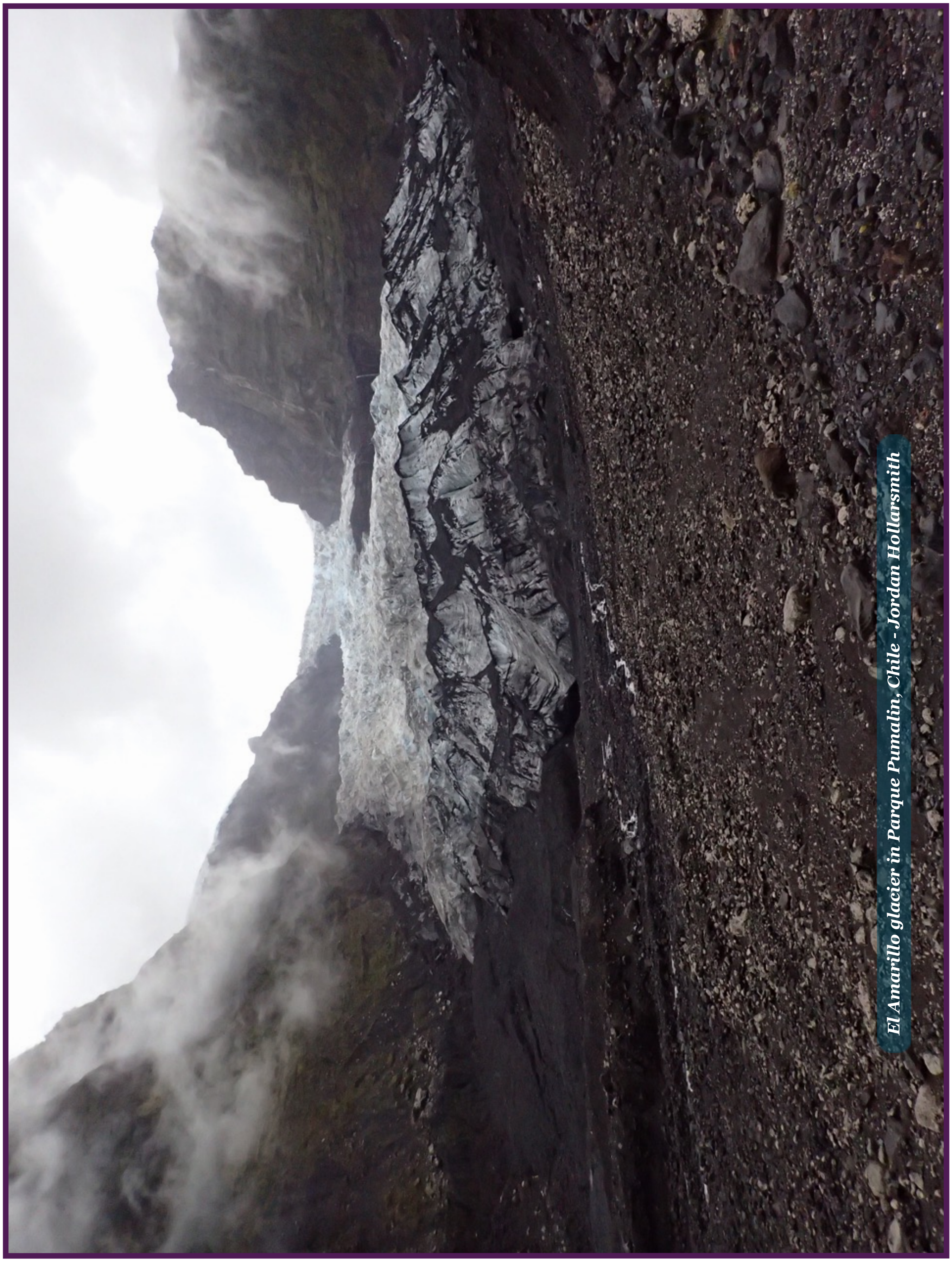
I'm pretty uncomfortable teaching topics that I don't know that well, and it is all too easy to end up straying into unfamiliar territory even in a course that you know well. On the other hand, this is oftentimes an opportunity to learn something new, and it happens all the time.

For me, the most rewarding moments in teaching come when I feel like I've communicated a complex idea well, or facilitated an experience which teaches something meaningful. In field courses especially, I feel like part of my job is to set the stage for meaningful interactions with nature and the process of science, and then to try to stay out of the way when it happens.

Do you have a best or worst day as a new teacher?

Yes, sometimes both in the same day.





El Amarillo glacier in Parque Pumalin, Chile - Jordan Hollarsmith

Teachers and teachees: The art of teaching in higher education

Madeline Gottlieb

Wow, GGE, you all care a great deal about teaching! Exactly 62 of you completed this survey on what makes a "good" teacher.

Bear in mind that this is not a rigorous, scientific study. We are aware that there is danger in drawing any kind of conclusions from this survey; we are merely presenting information for you to mull over in your abundant spare time. Enjoy!

To give you a sense of who took this survey:

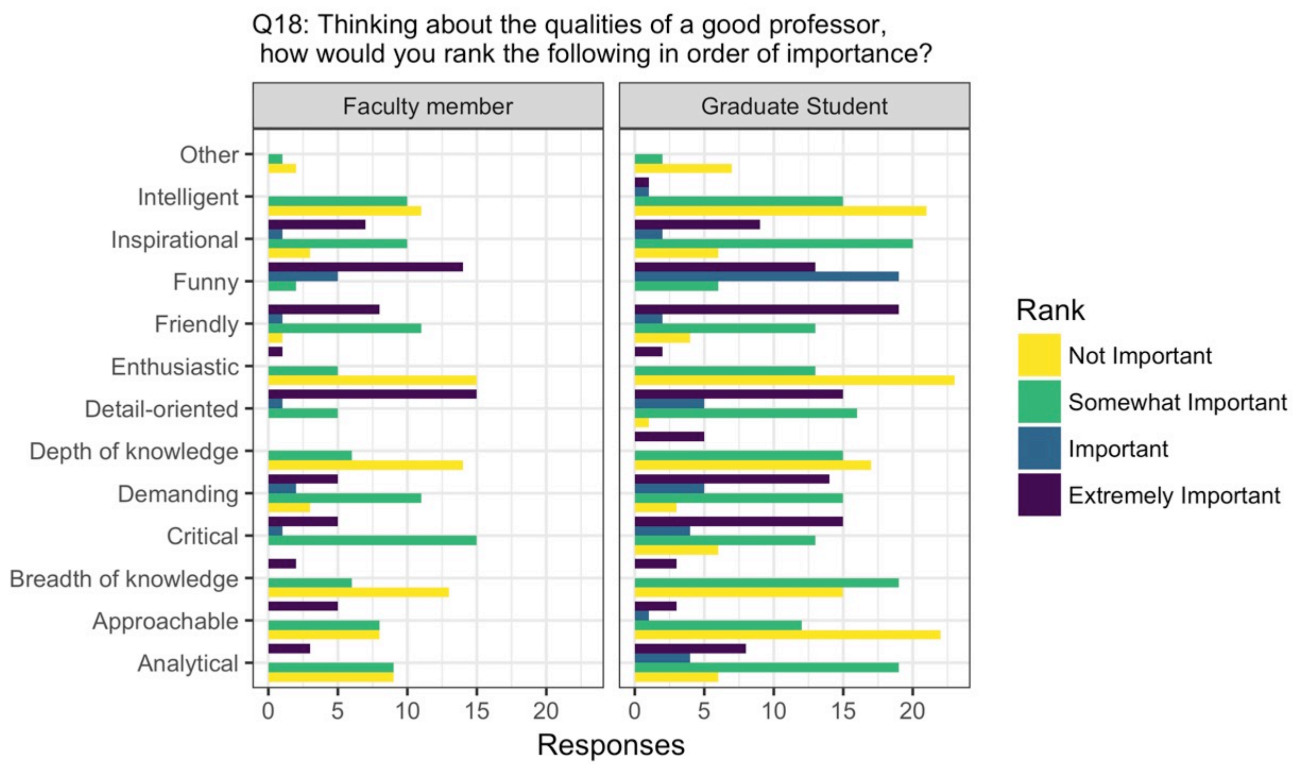
- **40 students**
  - 55% 2nd and 3rd years
  - 57% identified as women
  - 43% identified as men
  - 44% taught 4+ classes
- **21 faculty**
  - 80% tenured
  - 29% women
  - 71% men
  - 90% taught 4+ classes
- **1 researcher** (you rock!)

Overall, there were few major distinctions between faculty and graduate students in how they view the art of teaching. However, there were some surprising discrepancies between those that identified as men or women! Read on for more...

Interesting and noteworthy differences between faculty and graduate students:

In terms of what makes a good professor:

- Graduate students seemed to place more emphasis on being approachable and detail-oriented.
- Faculty thought it was more important to be critical and analytical, and have a depth and breadth of knowledge.



In terms of making the best class:

- Faculty members felt it was much more important to have a challenging and interactive class.
- Graduate students thought it was much more important to have clear expectations.

Regarding approaches to teaching:

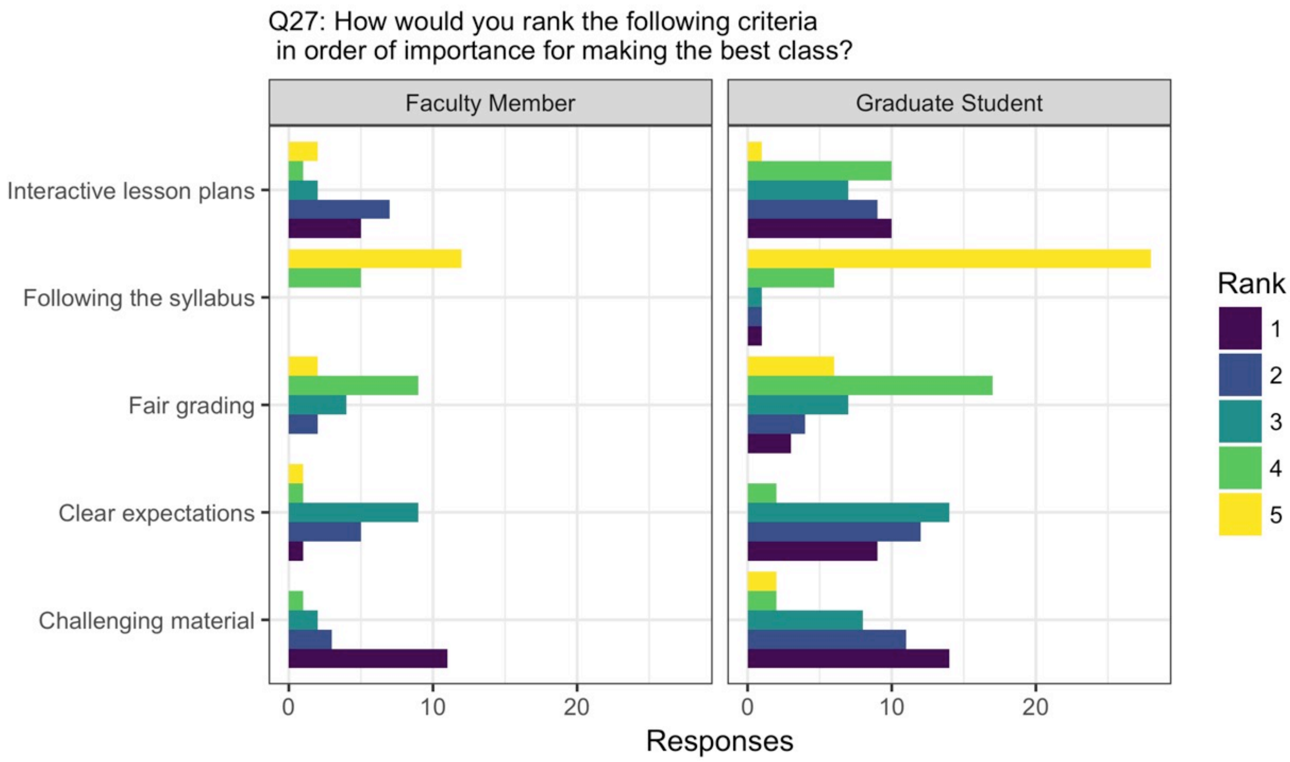
- Graduate students said:
  - "If the student doesn't understand, it's because you haven't taught it well enough"
  - "Course content should be communicated using diverse, research-based methodologies that are sensitive to the needs and backgrounds of the students"
- Faculty said:
  - "Teach like you love it"
  - "Set high standards and hold yourself to them as an example"

Interesting and noteworthy differences between faculty and graduate students:

- Thinking about the least favorite teacher you've ever had:
  - Those identifying as women were more likely to describe that person as intelligent (20% vs. 9%), while those identifying as men were more likely to describe that person as demanding (22% vs. 11%).
  - Women were more likely than men to indicate that their favorite professor was also the best professor, and their least favorite professor was also the worst professor (82% vs. 64%, and 54% vs. 36%, respectively).
  - Men were more likely to rank "demanding" and "depth of knowledge" as important factors in teaching, whereas women were more likely to rank "analytical" as an important factor in teaching.

In terms of making the best class:

- Men were more likely to rank "fair grading" as highly important
- Women were more likely to rank "interactive" as highly important



A couple key takeaways:

- Most of you (72%) felt that your favorite teacher was also your best teacher; but only 43% of you felt that your least favorite teacher was also your worst teacher.
- You overwhelmingly stated that the worst teacher you ever had was different from your least favorite in the following ways:
  - Apathetic, Disorganized, Didn't care about students, Unprofessional, and Boring

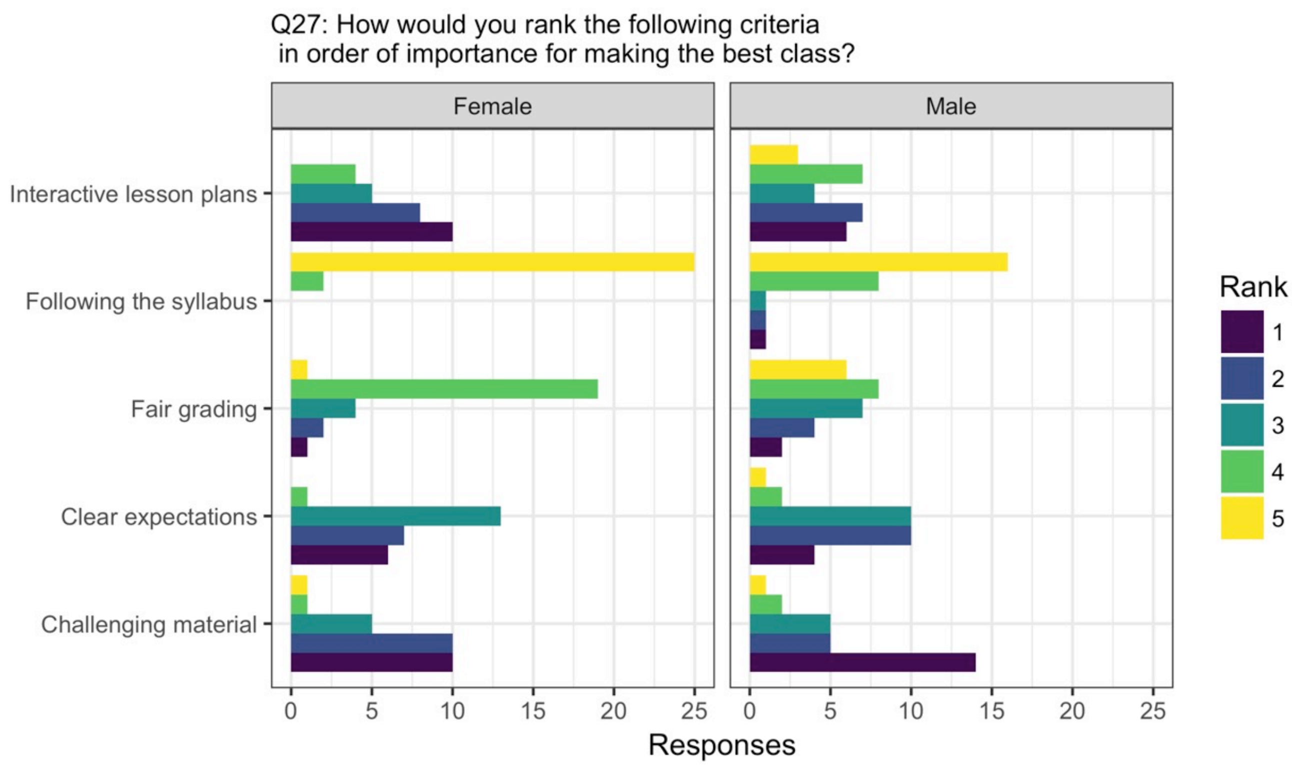
And finally, perspectives on important things not directly covered in the survey:

"My best professors were strikingly intellectually honest. They never tried to "fake it," show off or play mind games and one-upmanship in the classroom. Though I received my BA in 1966 and my PhD in 1970, I vividly remember my best (and a couple of the worst) professors AS PEOPLE, much more than I remember the course material. Though I was a Bio major, a couple of my best professors were in very different fields—Geology and PoliSci. The professor who was the single biggest intellectual influence on me was not on my thesis committee, and I never took a formal class from him, but his brilliance and charisma glowed in the dark."

"Gender, ethnic and cultural issues. A good professor must minimize their implicit biases in regards to these issues, and embrace equality and equity in respect to gender, ethnicity and cultural diversity, which maps with learning style diversity."

Figures created by Ryan Peek, code and raw survey data available on Github at:

https://github.com/ryanpeek/TAB_teaching_survey



Bee linocut print - Lisa Rosenthal

RESEARCH SPOTLIGHT

A rollercoaster ride of bumble bee abundance – The data I do, and the data I don't, have

John Mola

Just about two months ago I was hustling around McLaughlin Reserve capturing unsuspecting bumble bee queens as they searched for nests or sipped nectar from flowers. Like a B-rate super hero armed with a bug net and fanny pack full of collecting vials, I rained down ESPN Top 10 worthy sweeps of my net to gather as many queens as I could. I would chill them down, clip a foot off for genetic analysis, dab some paint on them for mark-recapture, and set them free.

Now, this bizarre pursuit to many is normal work for entomologists, but this year seemed special. Most years, you may need to intensely concentrate to find enough queens to make the field day worth the fuel and field station fees. A good day might net you 10–20 queens. Yet, this year, the number of queens was staggering. Many times, I simply ran out of vials or tripped over myself unable to decide which of the four queens within my sight to pursue. Several times I collected 50 or more in just a few hours (Figure 1). But why is this year special? Why are there so many queens out? And why could I have titled this article as being "confusing" rather than "bountiful"?

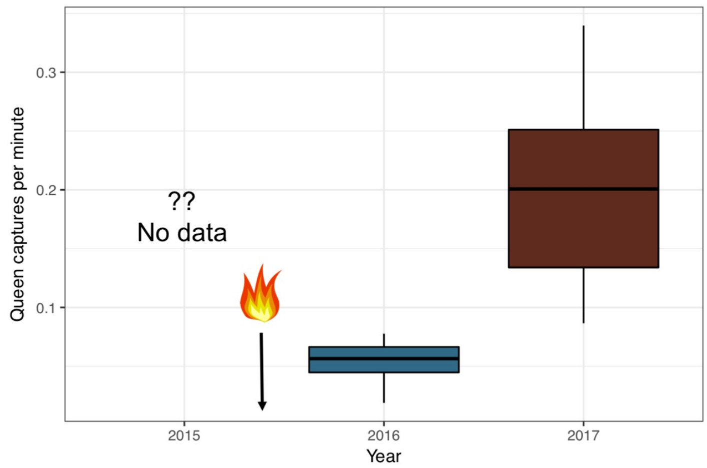
Let's start with the bumble bee life cycle. It is much different from the ubiquitous honey bee. In the spring time, bumble bee queens, known as foundresses, emerge all-alone. Large, gumball-sized individuals carrying all the sperm and eggs they will ever need within them can be seen hovering low over the ground looking for nesting sites. Once she has located a suitable dwelling, she establishes a nest and hurries to collect pollen and nectar to lay her first brood. Soon after, her daughter-workers emerge and the queen no longer leaves the colony. The workers take over the tasks of foraging and brood care, and the nest swells to maybe a few hundred workers, and eventually produces new queens and males late in the growing season. These new queens and males leave the colony in search of mates. The males, once spent, die alone, having lived essentially as flying sacks of sperm for just a few weeks. The new queens, successfully mated, burrow into soft soil and hibernate underground until the next year, ready to emerge as foundresses.

So, did you catch the key here? The bountiful bumbles I've observed this year were produced by colonies last year. And what was special about last year? Well, to understand last year we should jump back another year to the 2015 fires (this article is now following a Quintin Tarantino style timeline, keep up!). The Jerusalem and Rocky fires burned through McLaughlin Reserve in August of 2015, sparking a massive post-fire bloom of bumble bee beloved legumes in the spring of 2016. It is my thought that this post-fire bonanza led to the production of an astounding number of queens last year and the subsequent frenzy I observed this year.

While I find this result rather cool, it seems straightforward. We know time-lags are ubiquitous in ecological systems. Where it gets strange though is when I returned recently to McLaughlin, ready to make quick-work of collecting workers produced by those many queens, I was rattled to find little bumble bee activity. Just a few short weeks after seeing all those queens, just about when their first or second worker broods should be in abundance (and historically about the same amount of time between my queen collections and my worker collections), the meadows were ghost towns.

It seems to me that the cool wet winter we had delayed both queen emergence and flowering phenology. However, a few quick summer-like hot days for plants that are typically used to spring temperatures and it seems like the flowers flashed out. Now, I'm sure the bumble bees will go elsewhere to forage, maybe using less desirable plants in the spring-fed seeps, but this I do not know, and I observed few when I looked at the mimulus, blackberry, and scanty bits of lupine I could find.

So there I am. In a hot, dry, flower-less meadow where just a few weeks earlier I had been prancing about like Julie Andrews with a bug net, cursing the data I don't have.



***Boxplot** showing queen bumble bee abundance at McLaughlin Reserve. I have data for workers in all years and we did collect some queens in 2015, but only have data on queen capture rates in 2016 and 2017. We have little reason to believe that fire-induced mortality is why the capture rates are lower in 2016. Rather, it seems likely that 2017 was an exceptionally abundant year due to the intense bloom in 2016. Unfortunately, that's just conjecture given prior knowledge and what's available in the literature. The necessary data though, simply do not exist!*

Why don't I have daily flowering phenology? Why can't I find these bees? What was the queen abundance before the fire? Have I just gotten better at catching bees? Was last year really a crap queen year but a good year for workers, and this year is a good queen year and a crap year for workers somehow? Is that possible? I have too many questions and not enough answers. Here's a figure.

The bounty of bumble bee queens in 2017! A) *Trifolium fucatum*, a favorite food of foundresses, was in full-force this year, helping to drive rapid captures of queens. B) A queen with her mid-tarsus removed and painted with a site-specific dab of paint. C) A successful hunting day yields many vials of queen legs for genetic analysis.

PERSPECTIVES

Guest lecturing: CV gold and a pretty good time

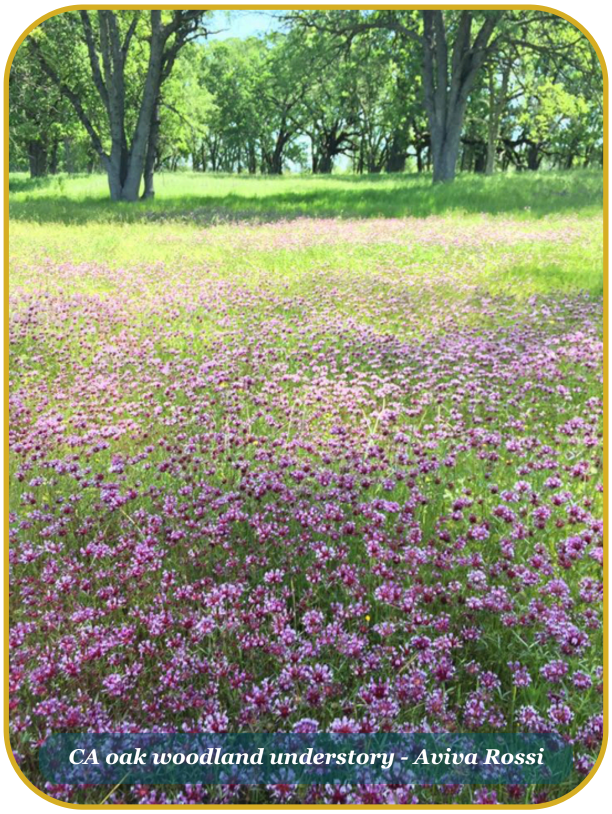
Brian Smithers

At some point in your grad school career, you have likely worked as a 'TA'. Your reasons for ending up in that predicament probably go something like this: 1) I need the money, 2) It looks good on my CV, 3) I want to actually learn the stuff, and 4) I like it. Almost all of us are faced with #1, but TAing has the added benefit of helping with #2 and #3. But maybe, just maybe, we find ourselves flirting with #4. In this little ditty, I want to challenge you to take your teaching beyond the TA-realm and into the dark art of actual lecturing. It's scary, time-consuming, and you won't be any good at it (at first)...BUT it will make you a better scientist—nay a better person—having stood in front of paying customers giving all you've got for an hour and a half.

Many of us are planning on careers where some form of lecturing is likely to be a major component. Grad school does a great job of preparing us to be researchers but it does a lousy job of teaching us to be teachers. The most efficient way to learn something is to do it and the opportunities are there to practice the lecturing craft. One just has to go and do it. Start with a guest lecture stint. Chances are that someone at Davis is teaching a class on your study system—that system you've studied an excruciating number of hours lately. An obvious route is to TA that class. Prove yourself not an idiot to the professor, then ask if you might give a lecture or two. I have had good success with this since, shockingly, teachers are generally thrilled to have the day off. Of course, you don't have to be the course TA to do this, but it helps if you at least know the teacher. The chances are high that if someone is teaching a class on a subject in which you are the expert, you know each other (or really, really should).

You have asked and they've said yes—now you've got to prepare the lecture. This takes way, way longer than you think it should. One might try to use someone else's lecture and adapt it for the task at hand. I have spent just as much (or more) time trying to make sense of someone else's slides and make them flow in a way that works with my mind as I would have spent creating the lecture from scratch. A better way to go, I think, is to look at a couple of other lectures on the topic, pillage some figures, and then have at it yourself. It will make much more sense to you. As a bonus, you will save yourself the super-awkward scene in which you are standing in front of 100 people saying something like, "I don't know what this slide means" (which I have done). Make slides as pretty and wordless as possible and then jump in.

A benefit of being a guest lecturer is that you likely have an experienced lecturer in the room. Make some mistakes. Get some pointers. Try it again. It starts to get really fun making a whole bunch of people smarter than they were before you started. I have done my time in the TA trenches: 2B, 2C, ESP100, 200B. I have also done some guest lectures and then last fall, was invited to co-teach ESP100. I'll be honest. I did it for reason #2. #3 definitely happened (now I understand the Coriolis Effect), and by the end, I liked it. I really liked it. You have a great opportunity to hone this skill before your paycheck depends on it. So, give it a try. Then put that shit in bold on your CV because your next employer will love it.



CA oak woodland understory - Aviva Rossi

Why did it have to be... a teaching assistantship?

Caitlin Peterson

Imagine a happy world in which all your grad school funding is external and you only have to find a Teaching Assistantship if you're super into teaching and just really want to do it. Now imagine that you've lived in that world for the past eight quarters, and suddenly someone asks you if you want to teach a couple of lectures, for giggles. Would you respond with the prescribed enthusiastic consent? Or would you react as Indiana Jones did when faced with a pit of snakes?

If the latter scenario has you thinking that the Indiana Jones type either has a weirdly aggressive negative reaction to teaching, is a spoiled freerider that doesn't understand the exigencies of the true grad school experience, or perhaps is just a self-centered kind of person, then, nice to meet you—I'm Caity.

A graduate degree is inevitably a selfish endeavor, unless you find some way of returning the debt owed to society for having humored you for so long. Becoming an academic in turn seems the most logical way to do that. Indeed, a continued career in academia often seems implicit in a PhD student's formation, and TA positions are a pivotal part of that preparation. So much so that even if you live in the magical world of external funding like I do, you're still encouraged to get a TA position.

Why, then, did it take me eight whole quarters to get my act together and teach a class or two? Why the pit of snakes?

I think I can eliminate simple incompetence or outright stage fright by virtue of my recent, very first experience teaching a full lecture, on my favorite topic of agroecology, to a group of wide-eyed and innocent undergraduates. I expected to embarrass myself. I did not. I did not fret and lie awake the entire week leading up to my lecture. I did not choke or stumble over my words. I did not even suffer a mortifying attack of armpit sweats. I was warmly complimented and thanked afterwards by my professor, who, when pressed, said that I didn't altogether suck as a speaker.

Good to know, I suppose, that I don't dislike the idea of taking a TA position because I'm a fundamentally bad teacher, or because I have an irrational fear of standing in front of a class. But still, I wasn't sure how to respond when my thesis advisor asked me, soon after my first lectures, how did it go? Is it something I could see myself doing more of in the future? Or when she then noted, with an acutely French sense of irony: someday you're going to have to figure out what you want to be when you grow up.

She was, of course, broadly winking at postdocs and faculty positions, for which I would ostensibly need more teaching experience and therefore TA positions. Snakes reared their awesome but admittedly kind of spooky heads again.

Given that I have satisfied myself that it is not the teaching part of doing a TA that rubs me wrong, it must be that wink, that assumption that TA positions are a pre-requisite and one-way highway to the tenure track, that gives me vertigo. Or, perhaps I should clarify, tenure track at an R1 research university, where single-minded pursuit of career is rewarded above all other exploits, including creativity, exploration, and service to society.

Professors of UC Davis, you are warmly welcomed to contradict me—after all, how can I know what your day-to-day lives are like, not being a professor myself? Nevertheless, from the outside it looks a whole lot like my friend and colleague, who also has her very own and very rad science blog, described it:

As a PhD student, "*publish more papers in higher impact factor journals, apply for every prestigious grant, get the best postdoc, then get four more postdocs until you can nab a faculty position. As a professor, continue to publish a laundry list of papers in prestigious journals, win all of the grants, and climb your way up the administrative ladder until you're not doing research at all, just paperwork.*"

-*Katy Dynarski, www.biogeokaty.com*

The above excerpt is an exaggeration, of course, but not an uncommon sentiment among angsty graduate students overwhelmed by thesis writing on top of TA duties on top of life in general. Professorship, public service, and a meaningful life are not mutually exclusive, but it does seem incredibly difficult to achieve that perfect trifecta under status quo incentive structures.

I often feel like I am swimming against the current as a PhD student planning on something other than an academic career. But the tides of graduate studies are changing and the view that a PhD means a default academic career to follow is becoming antiquated. In fact, more than half of STEM PhD students these days go on to non-academic careers[1]. At the risk of making an obvious distinction, let us remember one thing: all professors are teachers, but not all teachers are professors.

Embarrassingly, it seems that I had become hypnotized by this sea of inter-tangled snake heads in the pit of academia and forgotten that being at TA is about more than 1) paying the bills or 2) learning to be a university professor. I have learned much from my professors, some of whom remain my role models to this day. However, I have also learned much from books and stories, from works of art and music, from colleagues, teammates, and friendly strangers. It follows that writers, artists, musicians, mentors, parents, coaches – all are teachers in a way. Being a TA is the best and most direct way of learning to be a good teacher, an experience that carries over to career paths and interests well beyond the ivory tower.

If, while having the privilege to earn the highest degree that the academy can bestow I am able—whether by obligation or by choice—to hone the skill of teaching, then yes, it prepares me to be a better academic. But it also prepares me to be a better teacher, and therefore better human and more effective participant in my community. All of which is to say, those asps might not be so dangerous after all.

> *"Professorship, public service, and a meaningful life are not mutually exclusive, but it does seem incredibly difficult to achieve that perfect trifecta under status quo incentive structures."*

[1] American Institutes for Research. "The Nonacademic Careers of STEM PhD Holders." April 2014. Accessed 8 June 2017, http://www.air.org/news/press-release/sixty-one-percent-stem-phds-pursue-nonacademic-careers.

Sunset at Sunset State Park in Monterey Bay, Watsonville - Ryan Peek

Notes from a favorite experiment

Allison Simler

Just as science is a creative endeavor, art can be a methodical one. As an art student, I preferred to approach any daunting new medium like a scientific experiment, keeping a “lab” notebook to document the effect of different treatments, tools, and materials on the finished product. I noted diligently when 40 minutes of etching a copper plate in acid was too long, or when the softest wax crayon was too blurry in its effect, refining my approach with another round of little experiments. With so many mechanisms determining the final image, an experimental approach took some of the guesswork out of effective visual communication. I have been able to use a similar approach to pull apart mechanisms to improve my teaching as a TA for the UC Davis Art-Science Fusion program, a series of interdisciplinary science classes that feature art sections instead of lab components,

I’ve been a TA for the Entomology 01 Art-Science class for three years, teaching a “lab-studio” section where students used painting to explore and communicate concepts in insect biology. Unlike my previous TAships, I was responsible for developing lectures, rubrics, and assignments for my section. The class also attracted a wider diversity of students than other biology courses I’ve TA’d: plenty of future researchers and medical school students, but also, a surprising number of budding journalists, businesspeople, historians, and others, looking for something different from their norm. Typically, the only thing these students shared was a lack of formal artistic experience.

I needed to create lessons for students with different academic and artistic experiences within the confines of an unfamiliar course structure. Students were often paralyzed by the prospect of painting in class and being graded on something seemingly abstract. Drawing on my own experience, I explained how to approach learning a new medium like a scientific experiment. By encouraging them to record their artistic trials, critical thinking, not raw talent, became the currency. Students became braver about the course, taking risks and improving quickly.

Yet, I often felt overwhelmed by the diversity of audience and demands of creating an engaging, informative curriculum and often felt as uncertain as the students. Some sessions, I felt as though I was magically fluent in an art-science pidgin language, communicating effectively to the entire class. Other days, I’d be staring across a sea of blank stares and idly scrolling smartphones. I realized it made sense to treat my teaching like a structured experiment too. I began by admitting to my students that I had never taught a course like this before. I promised to provide a clear syllabus and set of expectations, but asked for their permission to test different lecture, demonstration, and organizational methods during class time. I solicited regular feedback from the students, polled them about which techniques made topics clearer, and asked comprehension questions at the end of sessions. I gauged understanding by letting students take the lead on their monthly critiques to hear how they structured feedback and presented the material when unprompted. I even developed a teaching rubric, scoring myself as certain concepts gradually appeared in their art. As with other new media, I kept a “lab” notebook with results from each class to assess my own progress, instead of just theirs, to give me a concrete sense of what to emphasize or alter the next week.

As researchers, we rarely launch field experiments without a small pilot to test new materials and methods. We don’t just cross our fingers hoping that in a few months, we won’t find a pile of ecological rubble that collapsed in the first storm. Students can be understanding of you trying something innovative-yet-imperfect, especially when you value those same skills in your assessments of them. Consciously structuring personal assessments helps me pilot new approaches and adapt to new courses and groups of students. Receiving incremental feedback, conducting ongoing experiments, and polling my students gave me more control over my improvement as a teacher than traditional course evaluations. Moreover, each TA assignment becomes a concrete opportunity to develop real teaching skills, even when materials are pre-prepared and structure is pre-determined. My confidence as a teacher grew with the realization that each class is worthy of a lab notebook and the same level of innovation and preparation that come with it. I am trying to make more spaces to note where my lecture was riddled with raised hands, where my demonstration ran long, or when that softest wax crayon was too blurry in its effect, refining my approach with another round of little experiments.

Let them find Pi: A closer look at project-based learning

Ernst Bertone

During my time working as a Teaching Assistant here in Davis, I came across several project-based learning activities, when students "learn by doing" instead of assimilating content given in a lecture. This was not the first time I worked with Project-Based Learning (PBL), but it was the first time I found myself in the teaching side of it. I started noticing that some projects got the students very excited and engaged, while others left them looking forward to the end of the class. Some activities had long-lasting effects, serving as milestones during the quarter, while others appeared to be easily forgotten.

So when should we use project-based learning? And how do we make or select good projects? Looking for these answers and trying to use resources from our community, I talked to Natalie Treyz, who teaches Calculus and Statistics at the Da Vinci Charter Academy, a project-based learning charter school here in Davis, and our own Professor Mike Springborn, who teaches Environmental Policy at grad and undergrad levels. They offered two (not very) different perspectives on teaching with and without projects.

When to do it? Spoiler Alert: not always.

PBL is not adapted to every situation, but works better in combination with other teaching methods. Different disciplines will work better with different doses of it. For Natalie Treyz, we should avoid using PBL when teaching abstract topics, when a concept is just a building block, or to cover many subjects at once. Mike Springborn often adopts the "Flipping the Classroom" model, in which students come prepared to class after watching videos and taking quizzes at home, and class time is mostly used for projects or discussions. For Mike, having the professor at the front is not always an effective use of classroom time, and there are many opportunities for learning outside class. Mike also thinks that PBL is the ideal tool to teach concepts that are non-native interests, which typically happens in classes that bring together students from different majors.

"*Having the professor at the front is not always an effective use of classroom time, and there are many opportunities for learning outside class.*"

How to do it?

The first key to a successful project is the story behind it. The students have to find meaning in the project and relate the subject to their lives, so they are willing to participate. This is something Mike calls "The Hook" or "the drive". The hook can be a narrative, a policy problem, or a political fact. For example, when teaching about the Social Cost of Carbon (SSC), the hook is the fact that the US government now wants to reduce or eliminate the SSC, and the students will care about that if they understand how the SSC affects government policy [it seems like Mike has a lot of hooks these days].

The second key is the takeaway, or the technical meat. For Mike, the conceptual meat is a generalizable concept or a tool that helps understand that concept. For example, when teaching about discounting rates, students can use a discounting spreadsheet as a tool and learn how to use Excel. For Natalie, the project needs to have at least one takeaway, every day. This is especially true on projects that last for more than one day, and students don't have to wait until the end of the project to start getting interesting conclusions. Which brings us to PBL's close cousin: Inquiry Based Learning. This is the method Natalie uses when not doing PBL.

Inquiry Based Learning is when students develop the intuition for a definition or concept, step by step. For example, when teaching $\boldsymbol{\pi}$, she first makes the students measure the circumference and the diameter of different circular things, like the bottom and the top of a glass. After measuring several different objects and taking notes on those measurements, the students can establish a relationship between perimeter and diameter. During that class, Natalie will also lecture about Gauss and give them useful formulas that use Pi. The proof or concept wasn't given to the students, they found out by themselves.

Challenges ahead

Students are often trained to perform well in a test, whereas PBL requires other skills such as collaboration and communication, which prepare students for community life. Natalie still needs to employ some traditional methods that give students college readiness (passing tests). The focus on test-based learning is particularly a problem for foreign students, especially if coming from test oriented cultures where group work and publicly speaking in class are not common. Mike thinks PBL makes their life harder, but they are working on their weaknesses.

5 steps for good Project-Based Learning (PBL):

1. *Have an end goal in mind.*
2. *The Hook: Students have to see the link between the subject and their lives.*
3. *Don't make an application that doesn't exist (always relate to real things).*
4. *The conceptual meat: Have at least one concrete takeaway, a generalizable concept, or a new tool.*
5. *Embrace the Chaos: Take risks! Not every class will be accomplishing, but you'll learn in the process.*

While direct lecturing prepares students to take a test, project-based learning prepares them for community life. Project based learning is sometimes viewed as non-rigorous, especially because of free-riders. But in Natalie's class if one person doesn't do their job, the whole group will probably fail. Everyone must be responsible so the group can succeed. Mike doesn't penalize students because their peers didn't work correctly, so the free-rider problem still persists.

So how do we assess students' performances? In Mike's classes, students must come prepared, ask questions and engage with the group. Since these aspects are only imperfectly observed, assessment can be viewed as subjective, and some students don't like it. That's where peer pressure comes in. When assigning readings before class, students grade themselves with preparation scores that are discussed and approved by the group. Not perfect, but effective enough according to Mike. Another technique is to ask students one or two specific questions about the reading. With technology things become easier: A new Canvas plug-in allows the instructor to embed an interactive quiz to a video, and the instructor can observe how students interact.

Finally, the outcomes of a project depend on whether the student will be a practitioner or a user. Most students will be users, but they still have to understand the mechanics of the concept. Learning outcomes need to be tailored to different students. At the end, experiences and projects will differ depending on students' background and future perspectives.

From camp, halfway up Mt. Rainier - Julia Michaels

Notes from teaching California Plant Communities, Spring 2017

Erik Grijalva

These quotes from students of this Spring's PLS 147, Plant Communities of California should warm the heart of anyone who teaches. On the last homework, we assigned them a "gimme" question; students were asked to describe which of the many plant communities or species covered in the course had most resonated with them such that it had them gushing to friends or family about our state's flora. As someone who can't get enough of California's superlative plant diversity and deeply loves sharing that enthusiasm: I'm not crying, you're crying!

"I thought vernal pools were awesome. I never really knew they existed." - *K. Hagen*

"I never knew that serpentine soils contributed so much to ... California's plant biodiversity." *– Z. Dashner*

"Of all the plant communities we've covered, my favorite by far is the Coast redwood plant community. As a native of Southern California, I am a lover of the ocean and the coast and I've always loved admiring redwood trees, but I truly fell in love with them after that lecture." – *M. Lamperts*

The opportunity

Word on the street last year was that Truman Young, professor in the Dept. of Plant Sciences was going to be on sabbatical for the 2016–17 academic year. One of the courses Truman teaches is the popular PLS 147, Plant Communities of California. Whether it would be taught in spring 2017 was up in the air. Truman sat on my Qualifying Examination committee, so during a break in my quals last year (because there was really nothing else to be concerned with) I volunteered to teach the course in his absence. I'd TA'd the course in 2015, loved it and learned a ton, so I naively calculated that I could teach the class and still have time for my research (and a life). No sweat!

Chhaya describing fire ecology, Calaveras Big Trees State Park - Erik Grijalva

PLS 147 is a course in Plant Sciences taught at UC Davis for almost 40 years, first by Dr. Michael Barbour and then, starting in 2008, by Dr. Young. The course is popular with a diverse group of students in ecology-related majors, the majority of whom are in their senior year. It is designed to give students an in-depth understanding of the singular plant diversity of the state via investigations of biogeography governing ecological processes, ecological history, disturbance regimes, conservation and restoration. Several years ago, the course was broken up into two parts, a lecture course and a field course, to allow for a more in-depth field component for interested students.

Both portions of the course are co-taught with the help of an enthusiastic, brilliant, engaged, [insert ten more grateful superlatives here] group of TA's. This year's team: Chhaya Werner, PhD candidate in Truman Young's lab in Plant Sciences, Connor Dibble, Ph.D. candidate in Steven Morgan's lab at the Bodega Marine Laboratory, Kenji Tomari, MS student in International Agricultural Development Graduate Group, and Rachel Wigginton, Ph.D. candidate in Ted Grosholz's lab in the Dept. of Environmental Science and Policy. There's no small sense of responsibility attached to the fact that this course is one of the last courses many of the students will take in college, and thus, one of the last ecological messages they will get before heading out into the wide world. Our team took this responsibility seriously, humbly, and joyously.

The lecture course, PLS 147: instructor-centered

The main portion of the class is a 3-hour per week lecture format. This is the typical direct instructional approach, with PowerPoint lectures, and periodic, but limited, time in the lecture hall for student interaction through targeted questions and experiential sharing. A handful of guest lecturers with specific expertise on select communities are peppered throughout the quarter to mix things up a bit.

We start with the climatic and geographic foundations of plant communities in California. We move, in a general way, eastward from the coast through to the east side deserts, including most of the communities within the political boundaries of California (not just the California Floristic Province). Each lecture is structured around a community or foundation species, (ex. vernal pools, serpentine, fire ecology, oak woodlands) exploring the unique aspects of each and what they have in common with other communities in California.

Canvas, Social Media, and a New Text

The development of the class for 2017 required a migration of course content from the now mothballed SmartSite learning management system to Canvas. Although there was a bit of a learning curve, I've found Canvas to be a vast improvement over SmartSite, with the ability to integrate various types of content in a more cohesive, user-friendly way. An active online Canvas community and responsive Canvas support services were a huge help in creating content and implementing various functions. Beyond simply providing the necessary course materials, my aim in developing the Canvas site was to provide a deeper layer of resources and opportunities for student interaction than could be provided in the lecture alone. With that in mind, I created a main page, updated weekly with clickable buttons to a suite of weekly modules and individual content pages that allowed students to explore at least some of the vast array of resources available on California Plants.

Krummholz Sitka spruce & students - Chhaya Werner

Coastal dune community - Chhaya Werner

Weekly modules included the lectures themselves, podcasts, readings, references from the lectures, weekly supplemental readings and homework links. The homework pages provided an embedded Google Form, which allowed for efficient grading in a downloadable spreadsheet, as well as a flexible format for different kinds of questions (short-answer, multiple choice, dropdowns, grids, etc.). To augment this main content, I maintained a page called 'Places to Visit' with a running list of topic-appropriate locations throughout California where students could experience the communities we were covering. An 'In the News' page listed a smattering of any articles I discovered that covered topics related to the class, a page for relevant videos, and a 'Links' page for botanical resources.

Canvas also allows for video conferences with the entire class (via BigBlueButton), and I hosted just under a dozen of these throughout the quarter to allow the students to discuss study questions for the exams, ask about homework problems, extra credit assignments, or expand on lecture topics. I found that the conference resource provided a more relaxed setting for students to engage with me, and I could give much more nuanced and detailed information about class topics in these sessions.

I also wanted to engage social media in the course, so I set up a Facebook group and an Instagram account, and asked the students to post in either or both locations any images they took, or links to items of interest related to CA plant communities. This was meant to be a student-driven exchange, with TA's and myself posting only periodically. This was a partial success: around a third of

Jeffrey & single-leaf pinion pine forest, student Facebook post - E. Kotcher

the class engaged in the Facebook page, and somewhat less on the Instagram page.

Up until this year, the course has been taught using the text *California's Changing Landscapes* by Barbour et al., published in 1993. Last year, a great new volume, Ecosystems of California, was published by Mooney & Zavaleta, Eds. The updated content, in-depth treatments of ecosystem types, and extensive references in each chapter make this new volume a natural for the course. The chapter arrangements and content in Ecosystems are not perfectly aligned with the approach or sequence of the lectures, so part of my preparatory work for the class involved mining relevant readings from Ecosystems and augmenting with the older Landscapes text. The book is helpfully available to students online through the UC Davis library, which obviated the need for students to purchase the book.

Mid-quarter survey and Canvas Use

Everyone teaching a course gets an end of the quarter evaluation from the students. I'm sure that they're helpful for the folks teaching courses year after year, but since this was a one-off for me, I didn't want to wait until the end of the class to find out that I was blundering about somehow, or otherwise missed an opportunity to connect that I could have capitalized on. So, during week 5 of the course, I sent out a mid-quarter survey to take the temperature of the students regarding the course. Survey topics were: instructor, lectures, homework, exams, Canvas materials, and general questions that provided more of an opportunity for students to make suggestions. The response rate was 39.2%, and I implemented many suggestions from the students and tweaked aspects of the lecture approach, Canvas site, availability and other items.

Of great interest to me, given the time I put into it (Canvas tracks your time, which can be a blessing and a curse), was just how the students were using the site. The survey allowed me to ask questions about the various pages and content, and overall this gave me the impression that they appreciated and were using most of those resources provided. I also examined the average amount of time students spent on Canvas for the course during the quarter (27 hrs. 51 mins.) and ran a correlation to homework grades, exams, and overall grade. Turns out there was only a hint of a correlation (0.26) for the first midterm, and similarly (0.23) for the overall grade.

The field course, PLS 147L: student-centered

The field course was more-than-ably led by Chhaya Werner and Connor Dibble, who traded field lecturing responsibilities, and whose natural teaching abilities were inspirational. Kenji Tomari, Rachel Wigginton and I played a supporting role, doing plant ID, driving, organizational work, and other tasks as necessary to herd cats and keep the proceedings running smoothly.

This portion of the course consists of four weekend field trips: two single-day trips and two 3-day trips. Students can take the field course by itself, but must have previously been enrolled in the lecture course. In contrast

The field class, 2017 - Kenji Tomari

to the lecture section, this is a more inquiry-based learning approach, with the students and TA's interacting throughout the day in a cooperative way. Field sessions were structured around an introductory series of lectures at each site, then having the students work through a suite of vegetation sampling methods, plant identification of key species, and community ecology. The heart of the field course is getting the students out into the communities, seeing, touching, smelling, tasting, and listening to the plants in their natural setting. There is simply no substitute for this immersive learning; exposing the students not only to the plants and the various geographic locations in which they are found, but also to an eager group of fellow students with whom they can pour over the information presented.

Our first of the single-day trips was to Jepson Prairie (valley grassland, vernal pools) and Suisun Marsh (brackish tidal marsh), the second visited the inner coast range near Lake Berryessa and Stebbins Cold Canyon Reserve (serpentine chaparral, foothill oak woodland, riparian forest).

Our first 3-day trip was to Mendocino, where the class stayed at Mendocino Woodlands State Park, a small village of cabins and common areas built in second-growth coast redwood forest by the Civilian Conservation Corps in 1938. We used this as basecamp to explore beach and dune communities at McKerricher State Park, coastal prairie, mixed evergreen forests, pygmy forests, and the 'ecological staircase' at Jug Handle State Reserve, as well the coast redwood community we called home for the weekend.

Main meeting area, Mendocino Woodlands State Park – Erik Grijalva

For the second three-day trip, which we call 'The Sierra Transect', our merry band of five UC Davis vans headed east to climb up and over the Sierra. Here we split our time between two camps, the first at Calaveras Big Trees State Park, the second at Grover Hot Springs State Park. This part of the trip covers the most plant communities, from chaparral and lower montane to alpine to east side single-leaf pinyon pine forests. While many of our students have spent time outdoors, the TA's and I were humbled to learn that a handful of students had never camped before, and this course was their introduction. The same is true for many of the plant communities we visited. Some, though, were rather well prepared, bringing elaborate "aero" coffee presses complete with their own scale to measure portions of ground beans.

On each trip, we wrapped up instruction with a quiz, where we asked the students to identify key plant species and answer ecological questions about the sites visited. During the overnight trips, studying for these quizzes involves laying out all of the plants encountered during the day, a fair bit of keying with Jepson, referencing various field guides, ribbing over pronunciation, and general botanizing geekery.

Rachel, Connor, Chhaya & Kenji – Erik Grijalva

These are some of the best times in the course, with the free exchange of information between the students and TA's, each of us learning from the others, and elevating the group as a consequence.

Final Impressions

There is often a false dichotomy posed in the teacher-student dynamic. From my interactions with the students of PLS 147, I'm confident that they learned a lot during the quarter. But is this more or less than I learned in teaching the class? Prepping for and giving lectures, answering insightful student questions, developing exams, holding office hours, administrative details, and working with the TA's, all gave me invaluable lessons. I can't thank the folks in Plant Sciences enough for their support, Colby Cronin and Lisa Brown, in particular. My advisers, Don Strong and Ted Grosholz, to whom I've been a ghost this last quarter. The TA's, Chhaya, Connor, Kenji and Rachel, who were an inspiration and fully represent the best of UC Davis. The students of PLS 147 and 147L who prove that the future is in good hands. And finally, Truman Young, for entrusting me with the course in the first place.

And in the spirit of starting with a quote, closing with a quote:

"As you may be aware, the Golden State Warriors championship parade will be taking place in Oakland at the same time as our final exam this Thursday. Is there any chance I can take the exam during the 6-8pm finals slot on Wednesday, June 14th? As a die-hard fan, I thought the least I could do was ask." – **Name Withheld**

(SOME) RECENT STUDENT PUBLICATIONS

GGE (current/former students) in **bold*

Aliperti, J.R., D.A Kelt, P.A. Heady III, and W.F. Frick. 2017. Using behavioral and stable isotope data to quantify rare dietary plasticity in a temperate bat. *Journal of Mammalogy* 98(2): 340-349.

Clatterbuck, C.A., L.C. Young, E.A. VanderWerf, A.D. Naiman, G.C. Bower, and S.A. Shaffer. 2017. Data loggers in artificial eggs reveal that egg-turning behavior varies on multiple ecological scales in seabirds. *The Auk*. 134(2): 432-442.

Heath, S.K., C.U. Soykan, K.L. Velas, R. Kelsey and S.M. Kross. In press. A bustle in the hedgerow: Woody field margins boost on farm avian diversity and abundance in an intensive agricultural landscape. *Biological Conservation*.

Lovich, J.E., R. Averill-Murray, **M. Agha**, J.R. Ennen, and M. Austin. 2017. Variation in annual clutch phenology of desert tortoises (*Gopherus morafkai*) in the Sonoran Desert of Arizona. *Herpetologica*.

Prado-Irwin, S.R., **A.K. Bird**, A.G. Zink, and V.T. Vredenburg. 2017. Intraspecific Variation in the Skin-Associated Microbiome of a Terrestrial Salamander. *Microbial Ecology*. 1–12.

Whalen, M.A., and J.J. Stachowicz. 2017. Suspension feeder diversity enhances community filtration rates in different flow environments. *Marine Ecology Progress Series*. 570:1-13.

Wolf, K.M., **M.A. Whalen**, R.P. Barbour, and R.A. Baldwin. Accepted. Rodent, snake, and raptor activity in restored perennial native grasslands is lower than in unrestored exotic annual grasslands. *Journal of Applied Ecology*.

A North Island Kokako feeding its fledgling on Little Barrier Island, New Zealand - Matt Savoca

COMMUNITY

Diversity Committee spring update

Helen Killeen, Mikaela Provost, Derek Young

Diversity Committee Mission:

The Diversity Committee will work to foster appreciation for the value of diversity in the GGE, to create and sustain a supportive and inclusive environment for all members, and to diversify our membership.

This quarter the Diversity Committee (DC) has accomplished a great deal. DC members have helped establish a campus-wide diversity training program, assisted in reforming the GGE admissions process, offered trainings and workshops to GGE members, and much more. Here's just a quick summary of what our subcommittees have been up to this Spring:

Outreach

- Published an online resource for GGE students interested in nominating E&E Seminar Series speakers (available on the EGSA Website).
- Organized the nomination of eight faculty members for the E&E series.
- Helped plan and secure funding for the new campus-wide Graduate Diversity Orientation Program Extension (GDOPx). GDOPx will bring together graduate groups to offer speakers, workshops, and trainings on diversity issues to graduate students throughout the year.

Trainings & Workshops

- Coordinated the first GGE Peer Education & Community Empowerment (PEACE) workshop in which attendees learned about allyship and communicating across differences.
- Started work on developing a new resource for incoming graduate students to help guide those from "non-traditional" backgrounds (i.e. community college, returning students, etc.) through the challenges of grad school.

Admissions & Awards

- Participated in admissions process for the 2017 cohort with DC members serving on the Awards & Admissions Committee.
- Reviewed statistics related to diversity for the incoming class and impact of the reformed admissions rubric (see Figure 1).
- Conducted a survey of students and faculty involved in the 2017 admissions process. Notable findings include widespread approval for the newly implemented "8 traits" that aim to quantify aspects of student diversity.

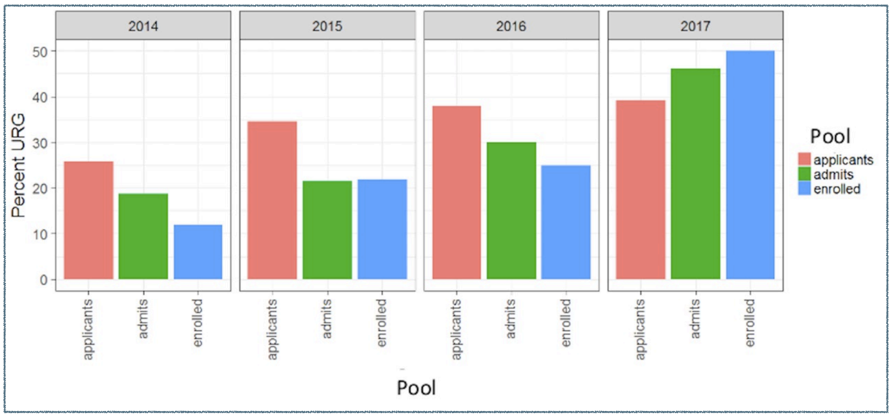


Figure 1. Percent of incoming GGE from "underrepresented groups" (URG), defined as not (European) white.

Percent of 2017 GGE cohort from URGs

Until recently, the GGE admissions process has had the effect of reducing the proportion of URG students from application to admission, and from admission to enrollment. This year, coinciding with the implementation of the revised "8 traits" rubric, which guides application reviewers in evaluating aspects of diversity present in prospective student applications, the proportion of URG students increased from application to admission, and from admission to enrollment. The "8 traits" rubric received widespread support in a survey of 49 application reviewers. In a dataset on applicant demographics from 2004-present, the 2017 cohort shows the highest proportion of URG students admitted and enrolled to the program.

A March for Science, and a Step in the Right Direction

Katie Markovich & Alex Webster

In the weeks following the March for Science, which took place on April 22nd (Earth Day), two major blows were dealt to the science community: Trump released his federal budget proposal outlining significant cuts to science funding, and then announced a plan to back out of the Paris Climate Agreement. In retrospect, it would appear that the March for Science failed. That would be true if the main purpose of the March was to keep science funding safe from cuts, or to miraculously convince the current administration that climate change is real. But it wasn't.

The March for Science began as a suggestion on a Reddit forum in January, and gained early traction amongst the Science Reddit communities. The March faced immediate criticism, and the most cautionary comments came in a peer review fashion from other scientists. While these op-eds were published left and right, we had our own debate about the pros and cons of a science march in the peer(ish) reviewed forum of ecology-social@ucdavis.edu. The debate touched on several of Robert Young's points from his New York Times opinion piece, that a March will accomplish nothing, that it might hurt science by politicizing it, and that we should focus our energy on storytelling and local outreach rather than reinforce the echo chamber we exist in.

Despite, or perhaps thanks to, this ongoing debate, the March heated to a simmer, and earned the endorsement from nearly every science society in the US. The op-eds changed their tune from "why the march is a bad idea" to "why I am not comfortable with marching, but plan to be there anyway." On the day of, 600 cities around the world held marches, with hundreds of thousands of participants, and the punniest, nerdiest protest signs the world has ever seen. Our local march in Sacramento had an estimated 10 to 15 thousand people show up in support of science!

The March may have been an echo chamber, or maybe it could better be seen as an incubation chamber, energizing scientists and spurring the difficult conversations that have been dormant for too long. One major criticism of the March was that it did not work hard enough to address the institutions of exclusivity, sexism, and racism within science that led to several organizers resigning before the March. So while the main purpose of the March was nebulous, and the controversy never quite settled, the very act of organizing and protesting served as a constructive platform for change, not just in speaking out against science denial and confronting the entanglement of science and politics, but also in improving our institutions to be more inclusive to people of color, women, disabled persons, etc.

Stuck inside the bubble of our own debate, we scientists may continue to underestimate the reach and value of the March. In Sacramento, I (Alex) had an excellent conversation with a fellow marcher. He was not a scientist, and definitely not a liberal, and admitted to being politically apathetic in the last election and not voting. But he was there that day, at his first march ever, to stand up for the value of basic research. He believed in the value of truth-seeking above all else, and could not stand to see politicians on both sides use the warping of facts as a strategy to gain power. I asked him if he would vote in the midterm elections, and he said that he would go door to door for any candidate that showed science some respect.

Ultimately, the March made us confront the uncomfortable fact that science and politics are intermeshed, whether we like it or not, because the value of truth is apparently not self-evident. It was an unprecedented and energizing symbol—one step on a long road ahead in confronting this anti-science administration, stepping outside of our bubble, and addressing exclusion and discrimination within our ranks.

DIVERSITY

Professors are critical in diversifying STEM

Helen Killeen, Michael Koontz, Ellie Bolas

In many ways, Jamie was the ideal college applicant. Jamie achieved high scores in science and math classes, worked well with others, posed thoughtful questions, and even spearheaded the school science club—an overall superstar. Jamie attended a rural high school in Mississippi where 97% of students were minorities and 97% received either free or reduced student lunches. In her senior year, she applied to and was accepted by a prestigious private school in Tennessee. Elated at the opportunity to travel and attend college, she started planning her courses for a degree in physics or engineering so that she could one day achieve her goal of becoming a space scientist.

Unfortunately, just before the start of her first year, Jamie was forced to drop out because she hadn't been aware that her full-tuition scholarship did not cover the costs of her mandatory freshman dorm.

Why would such a star student drop the ball on something as crucial as college financing? There are a few reasons. First, Jamie is a first-generation college student. First-generation students frequently do not benefit from the additional family support and guidance available to students whose parents or grandparents have prior experience with the college application and financing process. Jamie also did not have access to guidance counseling at school. School counselors often provide college-planning help to students; however, many schools in economically disadvantaged areas struggle with understaffing and are wont to reassign guidance counselors to other pressing tasks such as standardized testing, discipline, and administrative tasks. When it came to college planning, Jamie was on her own.

Having attending a local community college, Jamie is now on her way to transferring back to a four-year institution where she will likely succeed due to her overwhelming tenacity and perseverance. However, the challenges that she and many other aspiring scientists will face in college and beyond will continue to be an expression of their prior experiences and backgrounds. Each student brings his or her own past challenges, successes, failures, insecurities, strengths, and weaknesses with them. Just as no two set of experiences and backgrounds are alike, no two students have the same host of obstacles to educational achievement. So, as graduate students and future professors, we should ask ourselves, what role can we play in making sure that all students have the opportunity to achieve in a STEM education?

First, it's important to identify just why professors matter so much in efforts to enhance diversity in the sciences. It is not news that STEM fields do not reflect the diversity of the nation at large. Women, minorities, persons with disabilities, and non-native English speakers are underrepresented to the detriment of our field. Statistics on educational achievement can give us some insight into possible reasons for this disparity. Figure 1

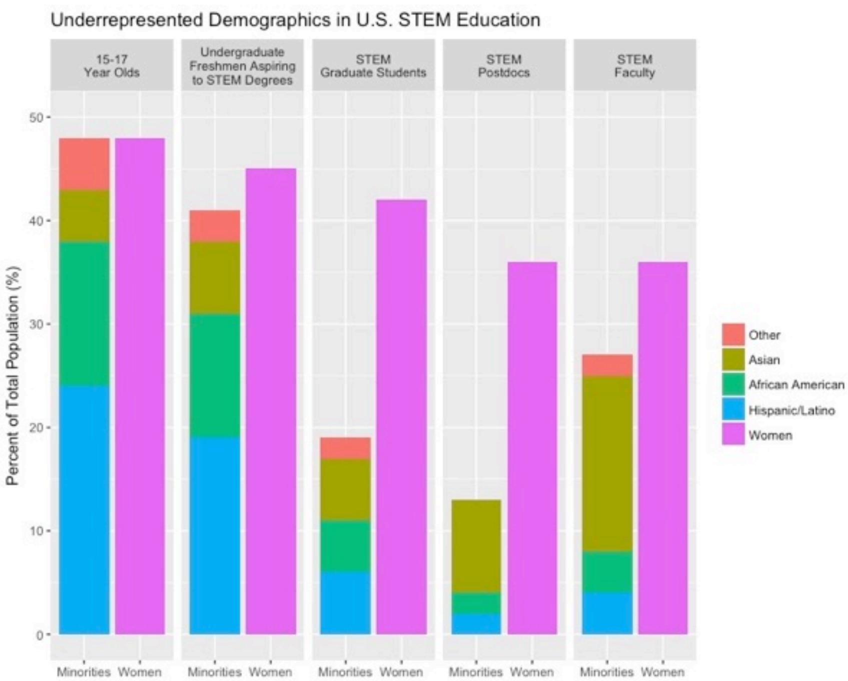


Figure 1. Proportional representation of women and minorities through various stages of STEM education in U.S. 2-year and 4-year colleges.[2]

shows a declining proportion of underrepresented groups in STEM fields through various levels of postsecondary education. This trend suggests that higher education acts as a filter, permitting fewer female and minority students through each successive stage. While minorities are well represented in the group of college freshmen aspiring to STEM degrees, this declines precipitously after the undergraduate years. Female representation also declines through successive stages of STEM education, but the trend is less dramatic. Notably, minority groups are better represented in the STEM faculty community than in graduate and postdoctoral studies; this is likely due to active hiring practices that aim to increase diversity in the professoriate and the inclusion of foreign-born faculty.

Box 1. Best practices for increasing undergraduate URG retention and degree completion rates. Recommendations adapted from National Academies of Science & Engineering.

Provide Academic Support to students recognizing that not all students have equal training in math, reading, and writing. Some students may require additional help and should be directed to course or campus resources that can assist them.

Connect Students to Research Experiences in ways that ensure students from diverse backgrounds are able and encouraged to participate. Hands-on research experience increases student competitiveness and competence.

Initiate/Participate in Summer Programs that target underrepresented groups. These can be valuable experiences that provide critically needed motivation and practice for K-12 and undergraduate students.

Encourage Professional Development in students by seeking out ways to connect undergraduates with networking, conference, collaboration, and presentation opportunities.

Promote Social Integration. Finding one's place in STEM can be a challenge for underrepresented groups, but is critical for persistence through programs of study. Develop ways to encourage student communication and feelings of belonging through classroom and department activities.

Mentor. Help guide students through the decisions and challenges, and offer an experienced perspective on career/educational development.

Seek out Continuing Education Opportunities. Campuses are increasingly offering ways for faculty to sharpen their communication, advocacy, and pedagogical skills. These are valuable opportunities to learn how to make classrooms and labs welcoming to diverse groups of people.

Use Data to track student participation and achievement in class and act when students are struggling. Doing so helps prevent students from slipping through the cracks, particularly in introductory courses.

Utilize Differentiated Instruction. Not everyone learns the same way, and lecture is not always what's best. Find ways to work within constraints and provide students with diverse learning experiences.

Advocate for underrepresented students in your department, institution, and community.

A critical period in the processes occurs during the undergraduate years. Although minority students have attained higher rates of admission to colleges and universities through decades of reform, there is a striking drop-off in the proportion that continue on to graduate school. It is therefore no surprise that the National Academies ranked increasing undergraduate retention and completion rates for underrepresented groups as the number one priority for increasing diversity in STEM fields.[1]

So, what does this mean for the role of educators at institutions of higher education? This means that in addition to balancing teaching, research, and grant writing, professors have a prerogative to take note of the ways in which they can enhance or deter retention and degree completion for students from diverse backgrounds. It means that we will need to be aware of and respond to the fact that we may have students in our classes who, despite great potential for success in the sciences, could be struggling to understand how to finance their education; who are highly motivated, but lack strong writing and reading skills; who achieve academically, but find it difficult to identify with their peers and scientific culture. Fortunately, there are many resources and models of successful intervention available to college professors that have proven useful methods of retaining and supporting students from underrepresented groups (Box 1).

Graduate students and professors alike play key roles in the academic ecosystem and thus it is incumbent upon us to ensure that all students have the chance to succeed in science. We can take steps to prepare for this work now by seeking out mentorship opportunities, learning about the obstacles faced by underrepresented groups in higher education, taking advantage of professional development to advance knowledge of inclusive pedagogies, and advocating for diversity in labs, departments, and other professional groups.

Increasing diversity in the sciences will require broad institutional and social reform across all levels of education, from pre-K through postdoc. However, the enormity of this challenge need not prevent us as graduate students from preparing now to make a difference as future educators, or even in the present as TAs. Indeed, there are many ways in which we can learn to make our labs and classrooms welcoming to students from all backgrounds, and with students depending on us there is no time to waste.

References:

[1] National Academies of Science & Engineering, Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline; Committee on Science, E., and Public Policy; Policy and Global Affairs. 2011. *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*. The National Academies Press, Washington, D.C.

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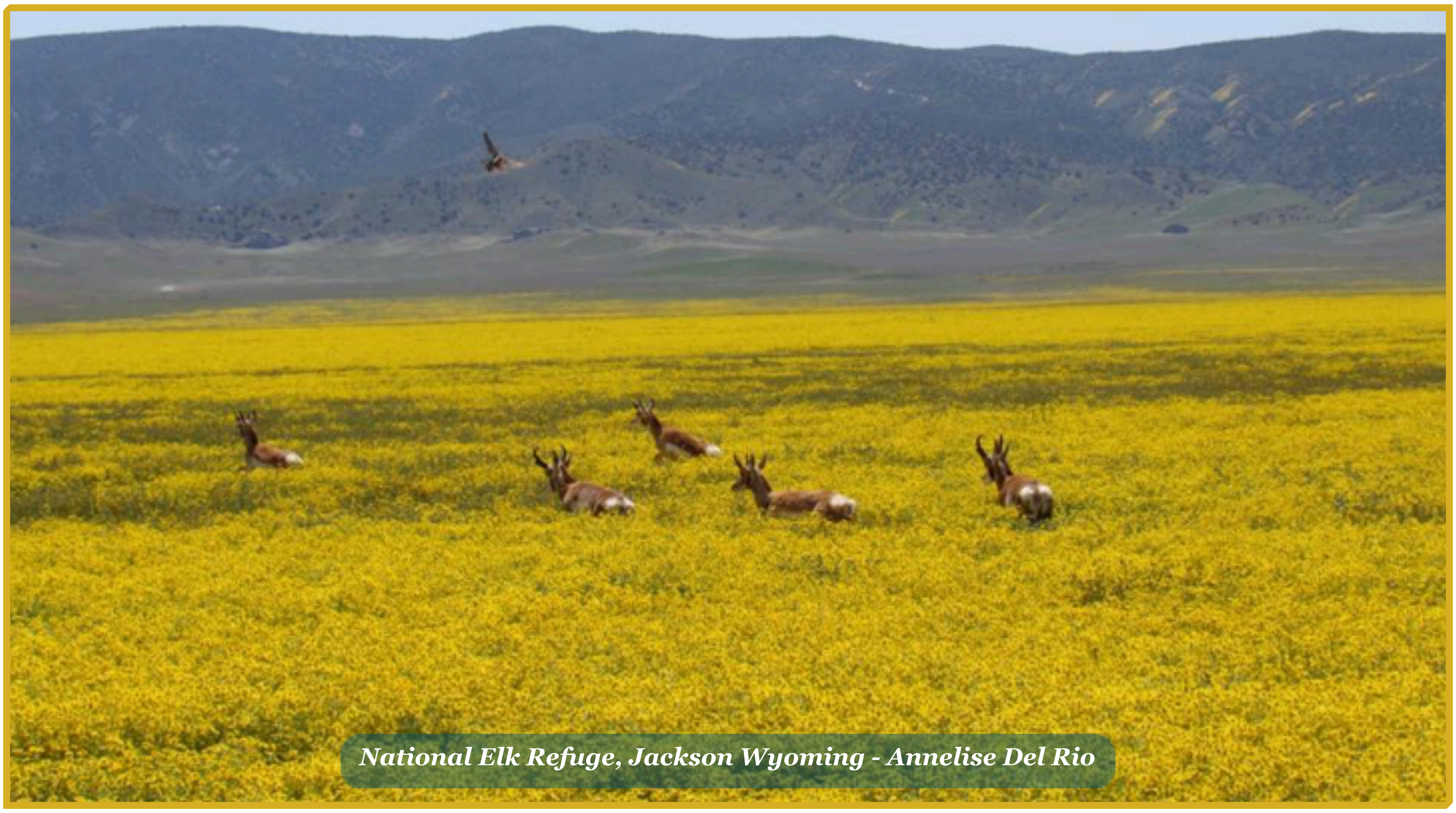

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Want to get involved? Comments, Corrections, or Concerns?

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