Chapter 2: Students

Now that you know what the assistant professor job is like, let us talk about PhD students. Your career will depend on your PhD students: their success is your success, and a large part of the job is about training PhD students to be successful, independent researchers. So how do you find, recruit, and mentor PhD students?

Let us first talk about what the admission process looks like.

2.1 Recruiting students: the admission process

If you are reading this book, it is likely you have gone through this process as a graduate student. But let me supply some more details as to what recruiting students is like from the perspective of a professor. Note that I'm talking about PhD admissions here: masters admissions are a different beast.

The application process. The process begins by the department putting out a webpage where students can apply. This will collect details such as name, educational qualifications, statement of research/purpose, transcripts, and scores from GRE and TOEFL. Students have to provide contacts for three people who will write letters of recommendation for the students. At some schools, the student might have to apply twice: once to the dept, and once to the graduate school/university.

At UT Austin, the student can specify up-to three professors you want to work with; this is useful since it allows professors to focus on the students who are interested in working on them. At some places, you just mention the professors you want to work with in your research statement (making it much harder for the professors to find students who want to work with them).

There might be a fee for applying. At some universities, this revenue is used to pay the support staff who handle applications. This fee might be waived in certain situations; you should always email and ask.

The application process generally runs from Sept to Dec each year, for admission for Fall (Aug/Sep) the following year. At some schools, the application process runs longer (until Mar). Some schools also admit students in Spring (Jan/Feb) with an earlier application process.

For professors who are looking to admit students, it helps students a lot if you are explicit about 1) whether you are recruiting students, 2) what you are looking for in prospective students, and 3) what you offer. Inspired by Philip Guo (UC San Diego), I've written something like this here.

Other than this, professors don't have to do much for the application process. Most of the work is handled by the awesome administrative staff in the department.

The evaluation process. How students are evaluated and admitted varies widely from department to department. Generally, an admissions committee will evaluate students and decide who to admit. Most of the committee members will be professors, though some students might be included as well.

The committee is generally looking to ascertain two things: 1) does this student have the intellectual chops and the persistence to do a PhD, and 2) is there a fit between the student and one or more faculty at the dept. A PhD is an apprenticeship – you will be working with a specific professor, so it is not enough to be academically good; if no professor wants to work on the topic you are pursuing, admitting you is not a good idea. So finding a good match is important.

The committee determines intellectual chops and persistence mainly by looking at grades and prior research experience. If the student has done research with a professor and the professor says in their letter "I've trained a lot of PhDs and I think this student has what it takes", that counts for a lot. In the absence of research experience, doing well in courses is a good indicator (though not the best indicator, the committee doesn't have much else to depend on in this situation).

How does the committee determine student-prof fit? The committee leaves it to the profs themselves. At most departments, as a professor, you will be able to examine all PhD applications. You can contact the students you are interested in, and interview them. You can then tell the admissions committee "I am interested in students X, Y, and Z".

At some universities, a professor has to commit funding to indicate interest in a student. So if a professor is interested in a student, they will have to commit to paying them for one year (see Chapter 3 for how much this can cost). This prevents professors from expressing interest in students without having sufficient funding. At some schools, professors combat this by pooling their resources and saying "Professors X, Y, and Z are interested in this student".

UT Austin does not require committing funding to express interest in students. This is a more flexible scheme, though it does lead to professors taking on students without first having the funding to pay them. UT Austin guarantees funding for all PhD students for five years via teaching assistantships; otherwise this could be bad for students. Many schools (though not all) will guarantee funding via TAs for some number of years.

How does the committee determine how many students to admit? The committee will ask profs in the dept, and they will each say something like "I am recruiting 1 student this year". The committee then has a sense of "demand" in each area: for example, it knows we are looking to hire four students in systems this year. If the demand is N students, the committee can't admit exactly N students, since some students will choose to go to other schools for their PhD.

The committee will look at historical yield, the percentage of students offered admissions who accepted the offers, to decide how many offers to make. For example, at many universities, the yield is around 30%; the committee will then make around 3*N number of offers. Sometimes this backfires with a lot of students accepting the offers, what is called a “success disaster”; it just means the dept won’t be admitting as many students in the next few years.

When you join as a professor, ask and figure out all these details – it will determine how aggressive or conservative you need to be when indicating interest in students. For example, if you can only commit funding for one student, it doesn’t make sense to interview more than three or four students for that role.

2.2 Attracting students to your group

Alright, we have covered the process of how students apply and get admitted. But how do you get students to apply in the first place?

The more famous and highly-ranked your university is, the less of a problem this is in general. But even so, if you care about diversity and inclusion, you might need to make an effort to get students from those groups to apply.

Let’s look at this from the viewpoint of students. What makes an attractive destination for their PhD? Students want to go to a university where 1) they can work on their topic of interest, 2) with a stable funding situation, 3) with good job prospects, 4) that seems fun!

For international students, rankings matter a great deal as they are not able to visit the universities in person before making a decision. So students typically end up going to the most highly-ranked university among their options.

This can be both good and bad: higher ranked universities typically have more money, attract stronger students and faculty, and have a stronger brand that can help with job hunts and more. However, international applications tend to place too much emphasis on ranking, thinking that there is a lot of difference between ranks 14 and 17 (there is not). But in any case, professors should be aware that this is happening.

The most concrete thing you can do to attract students is **do good research** and **build a good brand.** The good research part is obvious: if you publish at good conferences and have real-world impact, that is going to be attractive to students who wish to do the same. The brand part is especially important if your university as such doesn’t have a great brand. You need to get the word out about your research group, especially if it is a new group at your department/university. For example, if your department has not had any faculty working in HCI for decades, HCI applicants may skip over it; you need to make sure potential applicants are aware of your new group.

By “build a good brand”, I am not talking about anything complicated. You should spread the word about your research, both your papers and your broader vision. Talk about what kind of group culture you want, what you expect from students, and what you look for. Talk about the story behind the paper: the struggles, the different directions you explored before coming up with this, etc. Basically, talk about what life would be like in your research group.

Doing outreach. I recommend doing outreach to encourage students to apply. I did outreach at a number of Indian universities (including my alma mater). Doing outreach in post-COVID times is easier than ever: simply email someone you know at the university about giving a Zoom talk. I’ve never heard of anyone declining a talk, especially a Zoom talk. The talk should present your vision for your research area, the research you have already done, and some of the research you are working on/planning to do. Don’t make the talk too technical: it should be similar to a job talk – the overall picture is what matters. You should talk about what you offer to your students (they may not know that PhD students get a stipend!) and what you expect from them. If the talk is good, students will remember your group and apply, and faculty at the institution will recommend their students to apply in later years.

Developing pipelines. Some students will apply to your department just because of the university/department name. But you also want to develop “pipelines” of students from places you trust, where they apply specifically to work with you. Your undergrad alma mater is a good candidate for this. But you can also find other places. For example, I like to recruit from Microsoft Research India: they have a Research Fellow program where students can do research alongside experienced researchers for two years, and then apply for grad school. It is worth building a relationship with such places so that students know you and apply to work with you.

Looking out for diverse talent. The location of your university influences the demographics of the applicant pool (except international students). For example, some universities might get a lot of Hispanic applicants due to their location. If you want more diversity in applicants, you have to reach out to them. For example, giving talks at Historically Black Colleges and Universities (HCBUs) is a good way to encourage African Americans to apply to your research group. Diversity leads to different perspectives, which then leads to more creativity and innovation.

2.3 Identifying good students

Once students are applying for PhD admissions to join your research group, how do you identify students who are a good match for you?

It is crucial to pick strong students who work well with you, especially at the start. Your first students form the core of your group: they will mentor other students, your pre-tenure papers will likely be their work, and they will strongly influence the culture of the group. So pick your first one or two students carefully.

There are three situations where you have to evaluate students: when they have already been admitted to your university (new PhD students), when they are PhD applicants, and when they are potential PhD applicants (who are emailing you about wanting to work with you). We will discuss each of these situations.

Evaluating PhD students who are already admitted. Let me first talk about a scenario where you have joined the department in the fall, so you don't have any students, but there are a number of newly admitted PhD students who also started in the fall. Perhaps some of them don't have advisors yet, and they are interested in working with you.

There is a temptation to quickly hire anyone who will work with you: you have ideas, you have funding (thanks to your start-up package), what you lack is time to execute those ideas. But resist this temptation: students who aren't a good match will suck up a lot of your time, and will be a net negative. If your first student is someone who doesn't work well with others, other students will not want to work with you.

In my own case, I didn't know this at the outset, and basically got super lucky. This is why I say my success has depended a lot on luck at multiple points – of course I worked hard, but it is not hard to see that I was also lucky to get good students initially.

The best way to identify if there is a match between you and a student is to simply **work with them for a while**. Typically, faculty work with incoming PhD students for a semester or a quarter; if there is a match, they formally take them on as students from the next semester, funding them as a research assistant.

I recommend this "evaluation" period be shorter than a semester. In case there isn't a match, it is a waste of time for both you and the student. It is particularly expensive for the student, who can't afford to spend several semesters rotating with different professors before finding their advisor.

I suggest making a decision in about one month. You might think, isn't one month too short? Remember that you are not looking for the "maybe" cases here: you are looking for someone who is a clear and obvious match, who fits well with you and your style of research from the get-go. You can tell if you are working with such a person within a month.

During this month, work closely with the student: meet with them twice a week (or whatever cadence works for you). Start by giving them concrete tasks: don't give them a task like "here is this open problem, think about it and come back". Give them tasks where you know the solution, so you know how long it should take to do something. Ideally, the task should take about a week to complete; that way, you know if they are making progress at every meeting. At the end of one month, if you don't feel strongly that this will work out, tell the student politely, let them work with some other professor.

One failure mode here is to feel bad for the student, and delay the separation point. Remember, if it is not ultimately going to work out, it is better for both you and the student to end the relationship as soon as possible. Don't feel bad here: it is better if the student works with someone who is a good match for them.

Another failure mode is being unable to make up your mind about the student. Perhaps after a month, you feel like you are not sure it will work out. My advice in this situation is to find a different student. The advantage of having a high bar initially is that you can tell pretty quickly – if you find yourself not feeling sure, then this is not the student you are looking for.

There is a chance that you don't find a student for one or two years – I know successful professors who went through this. While looking for your first PhD student, make sure to work with undergraduate students and masters students who are doing research. If there are other faculty in your area, co-advise their students with them if they are working on something relevant to your interests. But continue to have a high bar for your first few students on whom you will spend your time and money.

I want to note that this is not the only way to find good students. This is highly subjective, and varies from professor to professor. There is merely one data point, based on what worked for me.

Evaluating PhD applicants. Another situation is that you are evaluating PhD applicants who will be admitted for the next year. This is a much harder problem, since you can't really work with students to figure out if they are a match. However, remember that you are only looking for students who could *potentially* work with you: it may not work out after a student is admitted and starts working with you. So you are looking for the students who, if they are admitted, you would want to work with.

Examine the applications of students who say they want to work with you. You might have subjective criteria you use to determine a match: for example, I look for experience building software (such as Google Summer of Code), since this is a necessary skill in systems research. If you have done outreach before and you know and trust some institutions (such as your alma mater), keep an eye out for that too.

Make a short list of the students who seem promising. Email the students and schedule a Zoom call with them. In these calls, I try to get a feel for the students and whether they would be a good match for my group. I find that talking to the students for a short time (15–30 min) is extremely useful in figuring out if they would be a match. The calls are enough for me to find the few students I'm interested in working with each year.

Evaluating *potential* PhD applicants. Once you start as a professor, you will regularly receive email from students who want to work with you. You can ignore these emails, or just ask them to apply during the department application process. But sometimes these emails allow you to find diamonds in the rough.

The essential difference between PhD applicants and *potential* PhD applicants is *time*. If the students email early enough, there is still time to work with them remotely to figure out if there is a match. Here is what I do: this doesn't work for non-systems PhDs, so it is not a general technique, but you might be able to adapt it.

Most of my projects are open source on Github. For each project, I create small issues on Github for small, simple additions/updates that I want to do over time. These are simple enough for an undergraduate student to tackle. So when a student emails me saying they are interested in working with me, I simply point them to Github and ask them to take a shot at any of the issues.

This step is amazingly effective: more than 95% of students who email vanish at this point. The remaining 5% tackle the Github issues, and about 1% actually ask meaningful questions about what they have done so far and what to do next. Those 1% are worth mentoring, and I have found a couple of strong PhD students in this manner. I always write letters of recommendation for all the students who work with me in this manner remotely, regardless of whether they are a good match for my group.

The drawback of this approach is that you are asking students to do a significant amount of work on top of their regular undergrad workload. Not all talented students would be able to take the time to do this. Unfortunately, I know of no other way to find the "diamonds in the rough".

So now we have talked about the admission process, how to attract students to your group, and how to evaluate students who apply. Let us next discuss how to manage students.

2.4 Managing students

Most professors don't have any formal training in managing people when they start as a professor. I didn't when I started. So if you are reading this as a graduate student, know that there exist workshops that you can attend to get some of the training you need!

A big part of being a professor is managing students. You want to make sure your students are happy and productive, and that they are progressing through their PhD. An advisor bears significant responsibility towards their students: in a sense, they are entrusting their academic career to you. You should make sure not to abuse that trust.

A lot of what I'll say in this subsection will seem obvious to experienced managers. But it wasn't obvious to me when I started, so I think it is worth laying it out.

An important thing to remember when you hire your first PhD student: don't expect them to be as productive as you are! It is unfair to compare a first-year PhD student (with perhaps no prior research experience) to your trained, experienced self. It is sometimes hard to imagine us back as we were in our first year when we didn't know anything. So be patient with your students!

Work hours and being professional. This is pretty basic: your relationship with your student is a professional one. You are their employer and their manager. You have a lot of power over their career: don't abuse it by asking them to do non-professional things. You can be friends with your students, but you still need to maintain that boundary. Barring deadlines, you should not be expecting them to be available for meetings in non-work hours and the weekends. Don't intertwine your personal life with their personal lives.

The basic setup. Many professors meet with their students one-on-one for about 30 minutes to an hour each week. In addition to this, some professors also have a group meeting that is used to communicate what everyone is working on to the rest of the group. This is especially useful if your students are working from different places. Use a spreadsheet, or whatever organizational software you fancy, to keep track of what each student is working on: the papers that are submitted, where they are in their PhD, and the next milestone/deadline they are working towards. This is easy to remember when you have one student; I have six students currently, and using tools to keep track definitely helps!

Management style. Management styles vary widely among professors. Some professors are hands-off, meeting with their students once a month. I have even heard of professors who only meet with their students once a semester, typically to sign forms and get a high-level update. Other professors are super hands-on, basically working with their students on a daily basis. Depending on the working style and personality of the student and the advisor, a lot of different management styles can be a good fit.

Generally though, I find that with junior students, being hands-on and communicating frequently helps a lot. Junior students need a lot of hand-holding, and especially for the first one or two students, they are getting 100% of their mentoring from you. Once students are more senior, they can help mentor new junior students. But it is important to invest the time in training the first few students.

Two key things helped me in managing my students: **setting expectations**, and **communicating frequently**. Students can feel unhappy during grad school due to two issues: the lack of structure and clear goals, and lack of communication and feedback. A student can feel adrift at sea: no clear goal to work towards, or trying to tackle a problem that seems too hard, unsure of how to do the next step. This problem is further compounded if the student infrequently meets with their advisor, leading to a feeling of being alone and being lost.

In my group, we combat this through "over-communication". I basically tell my students to contact me whenever they have something to discuss, they don't need to wait for our weekly meeting. I chat with my students several times a week when I see them in the dept, and if my door is open, they are welcome to come in and chat.

Back in the pre-pandemic days, I would usually start my day by going around their cubicles and chatting with the students. They would tell me if they are blocked on anything, and if it is

something small, I unblock them right away. Otherwise, we plan to meet later in the day. In this way, I'm always aware if a student is struggling.

When a student is having trouble figuring out the next step, we meet and brainstorm. I help the student with decomposing the problem into smaller parts, and figuring out what the next step to take is. Oftentimes, it is the act of meeting itself that is important: in this environment, the student figures out what to do by themselves. Often, my role is to provide the "scaffolding" for the student to get to the answer themselves; sometimes I provide technical input (typically when the student is more junior) but the non-technical help is more significant.

This style of working doesn't fit all students though: some students hate the constant interruption and meeting, so these students are not a good fit for my group. This is the kind of stuff that is hard to figure out by reading an application.

Setting expectations. One of the most important things when a student joins (or even before they join) is to set expectations. Tell them how long a typical PhD takes, and tell them about the milestones they are expected to hit (and when they are supposed to hit them). Ask them about their post-PhD goals, and tell them how you will help them attain those goals. At an individual project level, set the rules of how long you would tackle the problem together before declaring "too hard right now", shelving it, and working on something else. If you are evaluating a student, tell them clearly what you expect at the end of the evaluation period. If you are initiating a big joint project, talk to the student about their role in the project, and what they can expect to get out of it. For example, for any project with multiple students, I make it clear who the first author is before we start the project. I talk about whose dissertation the work is going into. Setting expectations upfront helps side-step a lot of problems down the line.

Handling different kinds of students. Your students are going to have a variety of working styles and communication styles. If you are advising a student, the two of you have decided that you have compatible working styles. Even then, there is a lot of room of variety. Some students might work 9-5 pm, others might be night owls. Some students may prefer to be in the lab all the time, others will only come in for meetings. Students might also have different goals after their PhDs.

For each student, you have to tailor how you mentor them based on how they work and communicate. Mandating one style for the lab will not work. You will have to figure out what you should ask of them so that they make progress without impeding their natural style. For example, asking a person who mainly works at night to come to the lab early in the morning isn't going to work.

At the end of the day, what matters is whether the student is productive. If the student is working in a team, that introduces additional constraints, but you should generally let the students have as much freedom as possible within those constraints.

Motivating students. A crucial aspect of being a professor is motivating your students, especially through inevitable rejection. This also applies to yourself – if you are becoming a professor, you have been pretty successful in academia; perhaps you didn't get a lot of rejections coming your way. But you will in the future, irrespective of how good you are; I've known successful, award-winning professors have their papers and grants rejected.

I recommend a "rejection routine". When the decision comes in, if it is a reject, don't read the reviews: there is nothing urgent you can do anyway. Go out with your students and get an ice cream, let the students rant, and get it out of their system. You can return to the reviews when you are ready, and see if you can use the reviews to strengthen the work.

When you meet with your students, appreciate them when they have done good work. Appreciate progress in their work. Be generous with compliments and praise. Sometimes as professors, we don't really realize the enormous value a kind word has to our students. When a student is working through a long project that takes months or years, it is important that they receive regular positive feedback.

What to do when expectations aren't met. Sometimes one of your students may be struggling with their project. It might have been a while since they made any significant progress in their project. The best thing to do here is to involve yourself as much as you can in their project, and help them past the hurdle. One of my mentors always ensures a student is un-blocked before they exit their office; they work on the problem together until then.

Sometimes, though, despite your help, the student struggles. This happens for various reasons – working style mismatch, personality mismatch, something happens in their personal life, etc. When this happens, it is important to be upfront about it, and see if you can fix it. Always set a time limit for the fix ("let us see if things improve in a semester"). Sometimes the cause is fundamental and not fixable: the student's working style just doesn't work with you and your group. While the hope is to figure these things out early on, sometimes they surface later. When this happens, you should sit down with the student and explain that you are ending the relationship; you should continue to pay the student for the remainder of the semester, with the understanding they find different funding from the next semester. Don't get into "why", it is rarely productive; politely but firmly explain that you are not a good match, and that you wish them well. If they are dropping out of the PhD and going into industry, help them with the job hunt.

2.5 Setting group culture

Group culture can be an important part of whether your lab is a thriving, collaborative place. I've heard, first-hand, of highly successful groups in top universities where students don't voice their ideas because other students will steal them.

An atmosphere like this can be avoided by setting expectations upfront ("who is first author on this project?") and acting quickly when you see a violation. For example, let us say a student makes a misogynistic comment. A quick, sharp "We don't make remarks like that here" will be

sufficient. If this keeps happening, you might need to have a talk with the student. But most students are sensitive to stuff like this, and will react quickly. Over time, the culture is embodied in your students themselves, and they will pass it to new students joining the group.

Students will feel safe in collaborations if they know their own ideas are safe and that their end-goals will be met. Have the difficult conversations about authorship and whose dissertation work goes into, up-front. Don't wait until the work is done: a student thinking they will be first author will be understandably upset if they learn they will not be.

Lay the platform for students in your group getting to know each other by taking them out to shared events such as dinner. Make sure new additions to the group are always included in team events.

Overall, if you take an active role in shaping the group culture in the initial years, it will self propagate as you add new students.