3 qualities of successful Ph.D. students: Perseverance, tenacity and cogency

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Every fall, a fresh crop of Ph.D. students arrives.

Since I'm actively looking for Ph.D. students, I get the same question a dozen times every year: "How long does it take to get a Ph.D.?"

This isn't the right question.

"Ph.D. school takes as long as you want it to," I tell them. There's no speed limit on how fast you can jump through all the hoops.

A better question to ask is, "What makes a Ph.D. student successful?"

Having watched Ph.D. students succeed and fail at four universities, I infer that success in graduate school hinges on three qualities: perseverance, tenacity and cogency.

If you're in Ph.D. school or you're thinking about it, read on.

What doesn't matter

There's a ruinous misconception that a Ph.D. must be smart.

This can't be true.

A smart person would know better than to get a Ph.D.

"Smart" qualities like brilliance and quick-thinking are irrelevant in Ph.D. school. Students that have made it through so far on brilliance and quick-thinking alone wash out of Ph.D. programs with nagging predictability. Let there be no doubt: brilliance and quick-thinking are valuable in other pursuits. But, they're neither sufficient nor necessary in science.

Certainly, being smart helps. But, it won't get the job done.

Moreover, as anyone going through Ph.D. school can tell you: people of less than first-class intelligence make it across the finish line and leave, Ph.D. in hand.

As my advisor used to tell me, "Whenever I felt depressed in grad school-- when I worried I wasn't going to finish my Ph.D.--I looked at the people dumber than me finishing theirs, and I would think to myself, *if that idiot can get a Ph.D., dammit, so can I.*"

Since becoming a professor, I finding myself repeating a corollary of this observation, but I replace "getting a Ph.D." with "obtaining grant funding."

Update: Within a month of writing that last line, I was awarded my first three grants.

Perseverance

To escape with a Ph.D., you must meaningfully extend the boundary of human knowledge. More exactly, you must convince a panel of experts guarding the boundary that you have done so.

You can take classes and read papers to figure out where the boundary lies.

That's easy.

But, when it comes time to actually extend that boundary, you have to get into your bunker and prepare for the onslaught of failure.

A lot of Ph.D. students get depressed when they reach the boundary, because there's no longer a test to cram for or a procedure to follow. This is

the point (2-3 years in) where attrition peaks.

Finding a problem to solve is rarely a problem itself. Every field is brimming with open problems. If finding a problem is hard, you're in the wrong field. The real hard part, of course, is solving an open problem. After all, if someone could tell you how to solve it, it wouldn't be open.

To survive this period, you have to be willing to fail from the moment you wake to the moment your head hits the pillow. You must be willing to fail for days on end, for months on end and maybe even for years on end. The skill you accrete during this trauma is the ability to imagine plausible solutions, and to estimate the likelihood that an approach will work.

If you persevere to the end of this phase, your mind will intuit solutions to problems in ways that it didn't and couldn't before. You won't know how your mind does this. (I don't know how mine does it.) It just will.

As you acquire this skill, you'll be launching fledgling papers at peer reviewers, checking to see if others think what you're doing qualifies as research yet. Since acceptance rates at good venues range between 8% and 25%, most or all of your papers will be rejected. You just have to hope that you'll eventually figure out how to get your work published. If you stick with it long enough and work at it hard enough, you will.

For students that excelled as undergraduates, the sudden and constant barrage of rejection and failure is jarring. If you have an ego problem, Ph.D. school will fix it. With a vengeance. (Some egos seem to recover afterward.)

This phase of the Ph.D. demands perseverance--in the face of uncertainty, in the face of rejection and in the face of frustration.

Tenacity

To get a tenure-track professorship after Ph.D. school, you need an additional quality: tenacity. Since there are few tenure-track faculty positions available, there is a fierce (yet civil) competition to get them.

In computer science, a competitive faculty candidate will have about 10 publications, and 3-5 of those will be at "selective" or "Tier 1" venues (crudely, less than 33% acceptance rate). A Ph.D. by itself won't even get you a job interview anymore.

There are few good reasons to get a Ph.D. "Because you want to become a professor" might be the only good one. Ironically, there's a good chance you won't realize that you want to be a professor until the end of grad school. So, if you're going to do Ph.D. school at all, do it right, for your own sake.

To become professor, you can't have just one discovery or solve just one open problem. You have to solve several, and get each solution published. As

you exit graduate school, an arc connecting your results should emerge, proving to faculties that your research has a profitable path forward.

You will also need to actively, even aggressively, forge relationships with scholars in your field. Researchers in your field need to know who you are and what you're doing. They need to be interested in what you're doing too.

None of that is going to happen by itself.

Cogency

Finally, a good Ph.D. student must have the ability to clearly and forcefully articulate their ideas--in person and in writing.

Science is as much an act of persuasion as it is an act of discovery.

Once you've made a discovery, you have to persuade experts that you've made a legitimate, meaningful contribution. This is harder to do than it seems. Simply showing experts "the data" isn't going to work. (Yes, in a perfect world, this would be sufficient.)

Instead, you have to spoon-feed the experts. As you write, you have to consciously minimize the amount of time and cognitive pain it takes for them to realize you've made a discovery.

You may have to go "on tour" and give engaging presentations to get people excited about your research. When you give conference talks, you want them eagerly awaiting the next episode.

You will have to write compelling abstracts and introductions that hook the reader and make her feel like investing time in your work.

You will have to learn how to balance clarity and precision, so that your ideas come across without either ambiguity or stifling formality.

Generally, grad students don't arrive with the ability to communicate well. This is a skill that they forge in grad school. The sooner acquired, the better.

Unfortunately, the only way to get better at writing is to do a lot of it. 10,000 hours is the magical number folks throw around to become an expert at something. You'll never even get close to 10,000 hours of writing by writing papers.

Assuming negligible practice writing for public consumption before graduate school, if you take six years to get through grad school, you can hit 10,000 hours by writing about 5 hours a day. (Toward the end of a Ph.D., it's not uncommon to break 12 hours of writing in a day.)

That's why I recommend that new students start a blog. Even if no one else reads it, start one. You don't even have to write about your research.

Practicing the act of writing is all that matters.

Translations

- Portuguese.

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