BLOG@CACM

PhDs from the Faculty's Perspective

By Jason Hong
November 5, 2012
Comments (7)

One of Blog@CACM's new bloggers, Philip Guo, has been doing a great job in discussing grad school from the PhD student's perspective (**here (http://pgbovine.net/PhD-memoir.htm)** and **here (http://cacm.acm.org/blogs/blog-cacm/155690-the-phd-grind-lead-from-below/fulltext)**). I figured it would be good to offer an complementary perspective of graduate school, distilling what I've learned over the past years in advising and working with PhD students.

Break Out of the Undergraduate Mentality
A common challenge for a lot of new PhD students is that they still have an "undergraduate r PRINT γ," where they believe that grades still matter (they do, but only marginally so), and that there will always be someone there to tell you what to do.

It's natural that a lot of new PhD students think in this way. The primary form of evaluation for undergrads is grades, and new PhD students have had 4+ years optimizing their thinking and work processes for that system. Similarly, most undergrad courses are geared towards "demonstrate that you can build this" rather than trying to answer more important questions like "what should we build, and why?"

As such, grades in graduate school don't really matter beyond the fact that you are above the minimum bars as set by your department. Instead, the main form of evaluation for PhD students is progress towards research, which, for better or for worse, can be approximately boiled down to research publications.

Now, having said that, you should do more than the bare minimum amount of work needed for your courses. The instructors for your course will be on committees reviewing your progress, and they will also be your future peers. Leaving a bad impression here won't help your case. Furthermore, you might miss a lot of wonderful opportunities for learning new things if you only do the bare minimum.

Most PhD students grow out of this undergrad mentality in a semester or two. The best thing you can do is realize that this frame of thinking exists, and to watch out for it if you feel it creeping over you.

Own your research
Following up on the point above, if you're waiting around for someone to tell you what to do, you're doing it wrong. The most impressive story I've ever heard about owning your research is from Ron Azuma's retrospective **So Long, and Thanks for the PhD (http://www.cs.unc.edu/~azuma/hitch4.html)** . Azuma tells the story of how one graduate student needed a piece of equipment for his research, but the shipment was delayed due to a strike. The graduate student flew out to where the hardware was, rented a truck, and drove it back, just to get his work done.

Note that, however, it's very likely you actually *will* start out by having someone telling you what to do. The vast majority of new PhD students are very smart and energetic individuals. However, the main things that new PhD students lack are an understanding of the research process and experience with the research literature. As such, it's usually easier to start out with a directing style of research with new students, with advisors telling you to read this paper, install this software, or build this app.

Over time, however, as you become more familiar with research methods and what's been done in the past, you need to take more initiative and ownership in your work. As you progress in your research career, you should still listen to your advisor, but take what they say only as advice. Ultimately, you have to own your research. You are the person who has to drive it forward, and you have to do what it takes to get it done.

How do I know when a student is doing really well? It's when the best thing I can do for them is to just get out of their way.

Be willing to push back
The second worst talk I've ever seen in my life was actually by someone quite famous in their field. I came away from the presentation feeling quite embarrassed, pretty much the same way you feel after watching Ricky Gervais doing another one of his cringe-worthy performances. The work this researcher presented made no sense whatsoever. There was no stated problem being solved, no rationale for why he did it the way he did, no new and interesting insights, and no clear innovation. It was pretty clear that this person hadn't read any research paper or seen any related commercial products in the area in at least over a decade.

I think there were two reasons why someone with such an accomplished career could make such a major misstep. First, this individual had a very strong personality and could easily dominate any conversation. Second, I think he inadvertently surrounded himself by people who were simply unwilling or unable to push back. In this particular case, without a strong counterweight, this researcher led his team into unfruitful directions that just made no sense, either from a research perspective or from a product perspective.

I tell new students this story as a cautionary tale.

I tell them this story because I want them to be able to stand up for themselves and make a strong case for what they are doing or what they want to do. Don't forget, if you're working full time on a project, you're spending far more time thinking about the issues than your

advisor is. You have 40+ hours a week to think about the problem you are working on, while your advisor probably has 5-10 hours (on top of teaching, travel, committees, and interactions with other students – this is why all faculty seem to exhibit varying degrees of brain damage).

If something doesn't make sense, or if you think that there's a better way to do something, you need to push back and make a solid case for what you think is the right thing to do. In situations like these, I have always found **Heilmeier's catechism (http://en.wikipedia.org /wiki/George_H._Heilmeier#Heilmeier.27s_Catechism)** to be an effective tool for thinking about problems. My students will tell you that I often have them take a step back and go through Heilmeier's standard set of questions to make sure they have thought through what they want to do and why.

Be active in the social dimension of research.
A common mistake I've seen with some graduate students is overlooking the social aspects of research. Graduate school is more than just taking classes, doing research, writing papers, and going to conferences. Graduate school is also about becoming a member of a larger community. It's about becoming familiar with the methods, tools, and values of your community. It's about participating in workshops, sharing your ideas with others, and helping to grow the field. And it's also about learning from each other, building on other people's work, and communicating with others what you have learned.

This same perspective also applies to your role in your university, in that you should be a good citizen for your local community as well. This might include helping to organize student lunches, participating in reading seminars, and making bridges with folks outside of your area.

There are several reasons why PhD students who can navigate the social dimension of research do better. They can absorb ideas from more areas, increasing their potential to make connections that others haven't seen yet. They can rely on more people for help, whether it is getting simple questions answered or getting access to more data or resources. Perhaps most importantly, they have a stronger social support network that can help them get through tough times (of which there will be many in grad school).

Build Up Your Skills, but Get Out as Soon as You Can
Although computer science is quite diverse, the best PhD students across all areas are actually quite similar. They are the ones who have solid critical thinking skills, a high degree of creativity, a strong work ethic, good writing and presentation skills, and a demonstrated ability to work independently with little supervision. Most students don't start with all of these skills, and so these are the goals you should be aiming for and critiquing yourself against as you make progress in your graduate work.

Graduate studies can be and will be tough. There will be numerous dead ends, frustrations, hardware and software that doesn't work the way it should, countless deadlines, and sleepless nights. On the other hand, there will be a lot of rewards, in the joy of making lifelong friends, mastering new skills, discovering new findings, and helping others. Perhaps the best way to close this column is with something I once heard attributed to **Stu Card (http://en.wikipedia.org/wiki/Stuart_Card)**, a pioneer the field of human-computer interaction: "Grad school will be the best years of your life. Having said that, get out as soon as you can."

Comments

Anonymous

November 07, 2012 10:15

I am a Carnegie Mellon PhD student, I agree with most of the article. I also thing you left one important piece of advice and is to have a goal. Without it time will vanish in task that are not important. Thanks for sharing your thoughts.

Diego

Anonymous

November 07, 2012 11:39

YES! I defended my dissertation after 5 semesters (first one was a dead end) while my best friend only took 17 years, although we got our master's together. At the time, I didn't recognize the above points, but I do now.

One thing I would add it that when you have passed your preliminary exams and present your research plan to your committee, consider it a binding contract. Do what you agreed to, and graduate.

Anonymous

November 07, 2012 12:56

Great article, and fun to read as a current PhD candidate!

Anonymous

November 07, 2012 03:04

I have to say, based on my experience, the points made in this article are very good. While I'm only a M.S. student and just finished my thesis I've noticed that in order to be really successful I have had to really dial it back on my course work. There has been a constant theme of, "Is this good enough?" in an attempt to maximize my takeaway from the course while not significantly impacting my time for research work.

I see that of the listed skills the one that seems to be lacking in most other students, at least among my group, is the ability to work independently. For example, our group had a new PhD student who, while he was getting up to speed on our research area and learning the needed skills (he was from an E.E. background and had little to no experience with a number of key C.S. concepts), was assigned to assist me with my work. I attempted to give him a simple task, "build a class that meets these requirements." In the end I spent more time telling him

how to do every aspect of creating this class that I spend probably three times as much time as it would have taken me to develop on helping him. The end result didn't even come close to meeting the requirements that I set out. It hasn't been my experience that students are very quick to learn this and, due to the busy lives of both professors and other students, this is probably the most vital skill to develop early on.

The other thing I wanted to mention is that, if your adviser doesn't welcome push-back about what you are working on there are a number of factors to consider. The first thing to consider is, as mentioned in this article, whether or not your idea is well thought out and has merit. If regardless of this you always end up having to do things their way it may be best to look for a new adviser. It could just be that you don't communicate well but you're not doing yourself any good by always buckling under and this will be harmful to your academic career in the long run. You need to be careful here though, as you should welcome feedback from anyone and if you're shutting down their ideas just because they are not yours you're still harming yourself. This situation in general is a tricky one.

Anonymous

March 14, 2013 05:56

In addition to almost all the agreeables, I think a good research starts with being 'challenged with a good problem', accomplished with 'sustained never-say-die efforts', 'self evolutionally rather revolutionary approach' and 'rigorosity overall in all the stages'; and finished with 'acceptable answers and other challenging problems'. Though commonly thought to be as output, it appears mythical to aim and windup by publishing. The dissemination and sharing may be immediate/intermediate gain only but not 'fine-grains' to be looked upto.
K. Mustafa, JMI

Anonymous

April 16, 2013 09:08

I think this applies to a lot of fields, but not exactly to bio or medicine related. The concept here relies on the hidden assumption that someone is right someone is wrong; which implies decidability. However, when decidability cannot be reached, playing the politics, sucking it up, not really arguing with people, and kissing up are all very important. Coming from a decidable field (cs, math, physics undergrad) and going into an non-decidable (cancer biology) is one of the most frustrating thing ever. Nevertheless, what is mentioned here is a baseline requirement. I think it's important to note, phd is not for everyone. If you like to get recognition from the general public, masters then entrepreneurial work is much better. If you like to have select people appreciate your work, but appreciate it a lot, then a phd is definitely good. If you hate reading (phd is not for you). I think that is also another good section that can be added, when not to do a phd.

I only listed a few reasons why I had such a horrible impression of science and phd, but they are all subjective. Shortest, phd is 2 years, longest 10 years, I am lucky to finish in 3, but don't waste unnecessary time doing something you may not use. Also, carefully consider the job market too to make sure your not doing a post doc for another 10 years.

Anonymous

July 18, 2013 11:15

As a private English language and professional development coach for highly ambitious nonnative speakers in science and engineering, I find that very intelligent graduate students may be good at learning enough content knowledge to complete a dissertation, graduate, and get a job, but they frequently do not have a strategic plan during college to develop themselves holistically in the professional global discourse, culture, and best practices of the very best in their field so that they can excel as genuine professionals with a much broader, more advantageous, range of expertise. Super achievers cannot become super successful unless they take full advantage of super mentors, coaches, or advisors who can help them use every minute of their academic career wisely, far beyond merely completing the minimum requirements for graduation. My advice to graduate students who want to surpass their peers in expertise and professional achievement: Take full advantage of the wisdom you can get from those who can guide your career preparation so that you can graduate with much more professional competence than other graduates typically possess. Wishing you success, Thomas Orr (thomasorrconsulting@gmail.com)

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