Building expertise

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This is 2003-me: a young graduate student who was inexperienced with many of the skills I would eventually need. 2003-me was good at taking classes but had no idea how to develop and teach a course. 2003-me would spend days staring at computer code trying to find bugs. 2003-me would spend weeks preparing to give a research talk. 2003-me had never seen a research proposal, let alone written one. I am now much more comfortable and efficient with all of those tasks.

Keep this in mind as a graduate student. You shouldn’t expect to start as an expert. Instead, aim to build expertise throughout your journey and develop the tools to continue growing after graduate school. I’m certainly not a formal ‘expert’ on this topic, but I have adopted a process that you might find helpful.

A process to build expertise

Expertise is the ability to call on a set of skills and knowledge in a given field. It requires experience, but experience alone is not sufficient to build capabilities or become an expert. I find the following process to be helpful.

1. Prepare for a task.
2. Test yourself to measure your progression.
3. Evaluate what went well and what did not.
4. Repeat, adjusting based on what you learned.

The following paragraphs describe some considerations for each of these steps.
**Prepare** To get started, identify a specific task and prepare for it. Homework assignments in classes are a good example—simply listening to lectures is not great for growth, but the assignment tasks make you focus and develop new skills and understanding. A helpful first step is to think about general areas where you want to build expertise.

Next, look for *incremental bets*: relatively small tasks that you can use to build towards larger goals, and use to evaluate your progress along the way. If a task takes hundreds or thousands of hours before you can test and evaluate, you won’t get timely feedback. Conversely, if a task only takes a few minutes or hours, your limited preparation won’t allow you to progress in building expertise. Not every task can be perfectly sized (e.g., you may be obligated to take on a big task as part of a deadline for your job), but the idea is to get to the stages below without too much time passing.

I can share some personal examples of incremental bets to help illustrate this. As a new professor, I needed to build expertise in proposal writing. So went to workshops where I could hear from experts and start drafting materials. I flew to Washington D.C. to meet with National Science Foundation Program Officers and get their advice and feedback on my ideas. I also wrote a few collaborative research proposals with more experienced partners who could serve as role models and teach me. And of course, I wrote lots of proposals that were rejected along the way, so not every task resulted in success. But over time, I grew (and am still growing) my knowledge of how to succeed in this area.

I had another set of incremental bets around writing on the topic of hazard analysis. My work led me to give many lectures on the subject, during which I honed my message. I also wrote several versions of short reports on the topic. Feedback on those reports was good, and at some point I set a goal to write a book on the subject. This goal probably involved hundreds of small tasks (reading literature on how to write textbooks, asking other book authors for advice, preparing a book proposal, finding trusted coauthors, learning to use code repositories to coordinate work, and lots of writing and editing steps). Eventually, we finished the textbook. The point is that I didn’t just sit in a room by myself and try to write a whole book from scratch—that would have ended badly, as I didn’t start with the appropriate expertise. Instead, I used many small tasks along the way to accomplish something that I wasn’t previously capable of doing.

Whatever your tasks are, prepare with *deliberate practice*: be systematic and focused, pushing to make progress rather than doing comfortable repetitions. Idly playing with your slide formatting won’t make you better at presenting. Writing e-mails might feel productive, but it doesn’t build expertise. Try finding a new idea (from a class, a book, or a mentor) and then working to apply it yourself.

**Test** Next, check your progress. Knowing that a test is coming will help focus and direct your preparation. Identify a test that will push you, and offer an outcome to evaluate and use for future preparation. The trick is not to overdo it or make it too easy. Pushing beyond your abilities and badly failing is not productive. If you’ve never run before, you shouldn’t start with a marathon. Similarly, you shouldn’t try to write a paper on your own without a lot of prior training. Conversely, an easy test won’t promote growth.

The above testing advice is admittedly vague—it is hard to develop a perfect test, and it is healthy to sometimes overreach and fail. I think about tests as part formal process and part mindset—I don’t want to go too long without getting some feedback on my progress.

**Evaluate** After each test, take stock of where you are and where to go next. Your performance may be self-evident (e.g., did the code you wrote in a new programming language work?). If not,
solicit outside feedback and coaching. Try to get honest feedback about how you did and ways to improve further. Your advisor can evaluate results from a new research approach you tried. A peer or mentor can review a paper draft or presentation and offer advice. A friend can record your talk and give you the video to watch yourself. Note that classes use this general format to teach you new topics and then evaluate your homework and exams.

**Repeat** Once you have feedback from a prior effort, identify your next task. You can try something more challenging or easier based on how things went. Or you can try something completely different if your interests or feedback indicate that a change in direction would be useful. Try to generate lots of ideas for tasks, but be selective about committing time to pursue one. Generating ideas takes relatively little effort, so it is good to generate many options. But deliberate practice and evaluation can take significant time and effort, so be discerning about where to direct your energy.

Looking back to the incremental bets I made in the *Prepare* section, I enjoyed the progress and got good feedback for the initial small tasks, so I moved on to more ambitious tasks. Conversely, there are other tasks that I struggled with or got negative feedback on, so I abandoned them before making larger bets (e.g., some types of committee work, and areas of scholarship where my ideas were not valued).

**Example tasks**

To get you thinking about areas where you could try this process, here are some potential tasks:

- Learn a new software tool and use it to produce a result or a figure for your research.
- Post some code to a repository to learn how to use the associated tools for this task.
- Record a presentation on your work and share it online (learning both presentation skills and technology tools).
- Give a presentation to a research group or at a workshop, perhaps using a speaking class to prepare.
- Give a presentation on a topic that you are trying to learn. The seminar will provide the test, and the teaching will force you to learn the topic well.
- Join a committee of a student organization or a professional society and learn about how organizations operate and are managed.
- Mentor a younger student.
- Write a short summary of a research idea as a test of your communication skills.
- Review a paper for a friend or a journal.
- Develop course material for a class if you are a Teaching Assistant (e.g., a homework assignment, a lecture, a handout).
- Write a short article or blog post about a topic you are interested in as a way to practice explaining an idea and to hone your writing.
Confidence

Confidence is having faith in your ability to take on a challenge. Ideally, it should be calibrated to your expertise. Overconfidence will get you in trouble and leave you with a bad reputation if you fail at a commitment you made. Conversely, lack of confidence may lead you to avoid situations where you could have been successful. The above process of testing and evaluating yourself can help build and calibrate your confidence. If you have tested yourself in a particular area (e.g., giving a seminar on your research), you should have a better sense of your capabilities in future similar situations.

Almost everyone in academia struggles with imposter syndrome. In my experience, lack of confidence is almost universal in graduate students, and overconfidence is quite rare. It is normal to be nervous or have feelings that you don’t belong, while also understanding objectively that your expertise makes you capable of contributing. Knowing that you have systematically prepared and built expertise should help your confidence in new situations.

Additionally, it is hard to feel confident if your mental model is that you are imperfect while everyone around you is infallible. Fight this erroneous idea by remembering that everyone has to start from a place of inexperience (remember “2003-me” from above). Further, everyone has weaknesses, blind spots, and insecurities. Senior people may have had more time to build expertise, or may be good at hiding their weaknesses, but they are not categorically different than you.

You will inevitably receive (fair or unfair) criticisms of your work or capabilities. Prior feedback from more trusted advisors, and your preparation, will hopefully provide some counterweight in those difficult situations.