

Engineering Success: Delivering Your Ph.D. on Time, on Budget, and Ready for Your Career

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Introduction

Successfully completing a doctorate degree takes a lot of hard work, perseverance, and determination. Throughout my time as a doctoral student, I searched for the key to success. I read books and blogs, sought advice from mentors, and learned through trial and error. I found that the skills that helped me succeed in undergrad were not enough for graduate school.

In this paper, I will convey three main lessons: time management tricks, managing your financial and health budgets, and setting goals. My first lesson includes time management tricks that I found to be useful. While pursuing a graduate degree, time is much more flexible. Depending on your habits, this can be a blessing or a curse. The second lesson is in managing budgets. A budget in graduate school could mean several things: the number of years of your funding, the grant that is funding your research, or your emotional health. The first two are straightforward: they are about managing a budget of time or money to achieve goals in your graduate career. Your emotional health might not be as straightforward to manage. Graduate school has emotional highs (e.g. success in research, accepted papers) emotional lows (e.g. rejected papers, failed tests) and stress. I learned that my emotional health is not something I could ignore. Taking time for yourself is important during your graduate school career. The last lesson of the paper is about setting goals and finding opportunities to achieve your goals. A common goal for earning your doctorate should be preparing you for your career in either academia or industry.

My Background

I am currently a Visiting Assistant Professor at Kettering University and I defended my dissertation on April 1, 2016, about 31.5 months after starting my Ph.D. in Systems and Entrepreneurial Engineering at the University of Illinois at Urbana-Champaign. Prior to starting my Ph.D., I worked in the aerospace industry for eight years as a systems engineer. During my first five years in industry, I completed a master's degree in electrical engineering at Iowa State University via their distance education program. Through both of my graduate degrees, I learned that having realistic goals, good advisors, and effective time management were keys to my success.

Purpose

I decided to write this paper because I learned quite a bit outside of classes and research during both of my graduate degrees. I used a variety of resources that I found useful. However, not all of these resources were easy to find. In this paper, I will consolidate these resources into one place and provide a brief overview of why I found each resource to be useful. Unfortunately, what worked for me will not work for everyone. Therefore, I asked a couple of close friends who completed their Ph.D.'s in a similarly short period for some additional resources. However, I am hoping that current and prospective graduate students may find some of these resources helpful to their success as well.

Setting Goals

Vagueness and confusion can lead to procrastination and lack of motivation.¹ One way to add clarity is to define clear long-term goals.¹ Covey's second habit is to "begin with the end in mind."² Both Tracy¹ and Covey² emphasize that importance in setting long-term goals to help make decisions on what to do in the short-term. You can set goals for your personal and professional life. Your goals can have varying complexity and time frames as well. Take some time to think about your professional and personal goals; they will serve as a guide throughout your time in graduate school. Tracy¹ provides seven steps that are helpful for setting and achieving goals:

1. "Decide exactly what you want"
2. "Write it down"
3. "Set a deadline on your goal; set subdeadlines if necessary"
4. "Make a list of everything that you can think of that you are going to have to do to achieve your goal"
5. "Organize the list into a plan"
6. "Take action on your plan immediately"
7. "Resolve to do something every single day that moves you toward your major goal"

As an example of Tracy's steps, I will walk through how one of my professional goals has shaped my career so far. Ever since I was an undergraduate, I wanted to be a professor at a primarily undergraduate institution (PUI). The first thing I want to point out is that the language of that goal has evolved over time because, as a first-generation college student, I did not understand the classification of PUI when I was an undergraduate. At the time, I just wanted to teach at a place like my undergraduate institution, so I started to make a list of what I needed to do by looking at the career path of my favorite professors. One thing they had in common was the ability to bring real examples into the classroom. Since I did not have much industry experience, I decided to pursue both industry and graduate school as an option at the end of my undergraduate degree.

Ultimately, I decided to take an industry position because it would allow me to gain that experience, plus I could complete my master's while working and my company would pay for it (bonus). I set a new intermediate goal and a deadline: after 5-10 years in industry I will go back to get my Ph.D. and pursue a career in academia (unless industry turns out to be a totally awesome experience that I do not want to give up). After completing my master's degree and eight years in industry, I quit my job and started a full-time Ph.D. program at the University of Illinois at Urbana-Champaign. During my Ph.D. program, the PUI part of my goal also shaped decisions that I made. For example, I looked for opportunities to get more out of teaching assistant assignments, and I decided to take a college teaching class because I knew teaching and understanding pedagogy would be important to PUIs. All of the steps in this paragraph were on my list what I needed to do to achieve my goal. While I was pursuing one of my degrees, it was easy to identify each day what I could do to move toward my goal. In between my degrees, I set study goals for the GRE, contacted potential advisors, presented at conferences, built my network, and volunteered in community organizations. All of the activities in between my degrees were also selected to add to my resume and increase my chances of acceptance into a Ph.D. program.

In my search for resources, I've noticed that the popular self-help authors (e.g. Covey,² Tracy¹) emphasize setting goals more than authors writing specifically for graduate students and academics. Some books about finishing a dissertation talk about daily writing goals;³ however, I did not find much about longer term goals. In my experience, I have found that my goals have been a tremendous help in keeping me focused during my Ph.D. For example, on days that I am overwhelmed with coursework or trudging through my ninth revision of a journal paper, I remind myself of my end goal. Most of the time that was enough to keep me moving through the hard times of my Ph.D. As I mentioned earlier, my goals also helped me to make decisions about how I spent my time. Therefore, I think long-term goals are an essential part of your time as a graduate student. Yet goals can evolve with you as you learn more about yourself and as your circumstances change.

Advisors and Mentors

Advisors and mentors are key components to a successful Ph.D. Advisors generally have a direct supervisory role during your degree and have the authority to approve key parts of your degree, like the final defense of your dissertation. I found advisors that supported my research and goals. In contrast, mentors provide advice and support but do not generally have authority to approve key parts of your degree. Through my personal network, I complemented the assistance my advisors gave me with that of several other mentors. I received lots of advice from my advisors and mentors that helped keep me on track to graduation.

During my Ph.D., I had two advisors. My first advisor was in my department. He was crucial in helping me find a research project, plan my courses, prepare for qualifying exams, and navigate department politics. Once I had selected a project, my first advisor admitted he did not have a strong enough background to advise me on one part of my project, so he encouraged me to seek out another advisor. My second advisor was outside of my department and complemented my first advisor. My second advisor was able to provide guidance in areas that my first advisor could

not. At first, I thought the two advisors complemented each other in the technical areas of my project. However, the second advisor also helped me to become a better academic writer through feedback he provided while I was writing my dissertation.

My relationship with my advisors included clear and consistent communications. Throughout my entire degree, I made sure that I understood the expectations they both had of me and what my goals were. For example, when it came time to make a plan for my dissertation and timeline to graduate, I called a meeting with both advisors and discussed the content of my dissertation and the timeline with them. At the end of the meeting, all three of us knew what I was going to write about and when I was going to have it done. After the meeting, I sent the notes of the meeting to everyone so we could reference the details as needed.

Unfortunately, during my master's degree, I did not have an advisor who completely understood the technical aspect of my research, nor were there clear expectations for graduation. In this case, I sought out another advocate in my department and referenced the graduate handbook on a regular basis. I also sought out a technical advisor at work. Since my project related more to my work in industry, it made sense to get technical advice from co-workers.

Throughout all of my degrees, I have also had several mentors, in addition to my advisors. Some mentors provided very specific advice, like advice on dealing with challenges as a woman in engineering or about returning to graduate school after being in industry. Additionally, once I got to the University of Illinois, I found a couple of other graduate students in my department and in the Society of Women Engineers (SWE) to help acquaint me with navigating campus and being a teaching assistant. I have connected with several mentors through SWE at the local, regional, and national levels.

Research

Research is the bulk of the work you will do in most Ph.D. programs. Once you have found an advisor, it is important to start narrowing down research opportunities.^{3,4} Your research is highly dependent on your advisor and their interest, plans, and funding. However, it is helpful to have a dissertation topic that you are enthusiastic about because you will spend years working on it, and passion and excitement will keep you working.^{3,4,5,6} Reis⁷ details a process for choosing your research topic and eleven questions to ask yourself (e.g., can it be solved?, is it worth doing?, is it a manageable size?) before committing to a project. The early stage of your research is the time to establish open and honest lines of communication with your advisor. You will appreciate their honesty later when problems arise with your research or when you are preparing to submit manuscripts.

The key is to establish a regular schedule and make progress on your research (almost) every day.⁴ Early in your degree, this might be simply reading an article related to your general area of research. In the middle of your degree, your daily activities will probably consist of data collection and writing conference papers. Conference papers are your ticket to a conference in order to network and share your research. It is also a way to get early feedback from your larger research community. I found that some of the questions that were asked after a conference presentation are similar to what my committee asked in my preliminary exam (dissertation

proposal). Toward the end of your degree, your daily activities will consist of data analysis and lots of writing.

My dissertation proposal was pretty informal, so I did not consult many specific resources; however, a mentor of mine recommended a book on writing proposals.⁸ I started on my dissertation within my first semester on campus. By the end of my third semester, I had identified three research questions and a data collection plan. Early and steady progress on my research was critical to my quick graduation date. However, not all disciplines or projects allow for such a quick turnaround.

Finally, both of my advisors set the expectation that I submit chapters of my dissertation to three journals before graduation. At first, this seemed like a major undertaking, but it turned out to be really helpful. In the end, it was not any extra work to submit the papers along the way. It helped me become familiar with the publication process under the guidance of my advisors. Now that I am familiar with the process and expectations, my first journal paper as a faculty member does not seem as intimidating.

A mentor once told me “the best dissertation is a done dissertation.” The thing to remember is that your dissertation is the start of your research career.^{7,9} It should be your best work at the time, but not the highlight of your career. Remember to use the time working on your dissertation to learn the skills that will help you succeed and produce more research in the rest of your career.⁷

Writing

Writing is a key component to every graduate degree because it is one of the common ways to communicate the results of research. Writing was also my biggest challenge in both of my graduate degrees. It was also the area that I was least prepared for coming out of my undergraduate degree. I found three things to be helpful in improving my writing: how-to resources on style, a growth mindset, and a regular routine.

I have assembled several resources in how to write journal papers and address writing style considerations. The first book, *Style: The Elements of Clarity and Grace*,¹⁰ was a gift from my advisor and I consult it regularly. The second helpful resource, “Writing the Empirical Journal Article,”¹¹ was also helpful in organizing my papers. I also consulted the style guides of the conferences and journals to which I submitted papers. It is important to pay close attention to rules from specific journals because Williams and Colomb¹⁰ say that it is okay to use first person; however, one journal I submitted to said you could not use first person. Also, keep track of differences in citation styles between conferences and journals. I like to use \LaTeX to make switching between styles easier. The reason this is helpful is that one of my journal papers for my dissertation will use IEEE style citations in the version submitted to the journal, but for consistency, my entire dissertation will have APA style citations. Some other helpful resources are the Purdue OWL¹², Grammarly,¹³ and the Grammarist.¹⁴ The Purdue OWL has great summaries of popular parts of the APA, MLA, and Chicago style guides.¹² The latter two helped me fill in the grammar details I forgot from high school.

I eventually adopted a growth mindset¹⁵, toward my writing. Since writing was not as easy for me

as other academic tasks, I continuously remind myself that I was still learning how to write academic research papers. I also told myself that the first thing I typed was not going to be perfect and that that was okay. Writing, just like any other skill, takes practice for some people. I am still working on my writing, but it has shown significant improvement over the last two years.

Knowing that I needed to practice writing, I tried to develop a regular routine, which included a habit of daily writing. This idea was somewhat inspired by Bolker.³ There were some semesters in which this worked better than others. For academic writing month (#AcrWriMo) in 2014, I did manage to write every day except thanksgiving and black Friday. It was my most productive writing month of my graduate school career. I still need to work on developing this habit, because I know it works, and it is helpful. Another helpful resource is to join a writing group. In the fall of 2015, I joined a writing group, and it was like having an exercise buddy. We met each week for three hours in a conference room and spent the entire time writing. We set aside the last hour for questions and collaborations if requested. We also had a rule of no social media or email during writing group. Some Wednesday mornings I did not feel like getting out of bed to go write, but I did not want to let my group mates down, so I was there every week I was in town.

Time Management

We all have 24 hours in a day and seven days a week and we make choices on how to use that time. Because I have struggled with procrastination my entire life, I do not always use my time effectively. I am getting better, but I still have work to do. Over the years, I have learned many tricks to using my time effectively, including prioritization, execution, and developing good habits.

Prioritization

The first step in prioritization is realizing that you cannot do everything, which is the easy part. The next step is to figure out what you can and should do, which is definitely the hard part. I personally have a hard time saying no when people ask me to do things. I have found a couple of different methods that seem to help. The first method, which I mentioned earlier, is making sure that what you do is aligned with your long-term goals. The second method is using Covey's quadrants; see Figure 1.² The x-axis of his quadrants ranges from not urgent to urgent and the y-axis ranges from not important to important. In Figure 1, I have added some graduate school specific examples in italics. Covey recommends that you spend most of your time on the tasks that are both urgent and important and avoid things that fall in the not urgent and not important quadrant.² Activities that fall in the important, but not urgent quadrant should be second priority.²

Execution

Once you have determined what you should be working on, the next step is executing effectively. I have found that the keys to execution are being organized, reducing distractions, and finding the

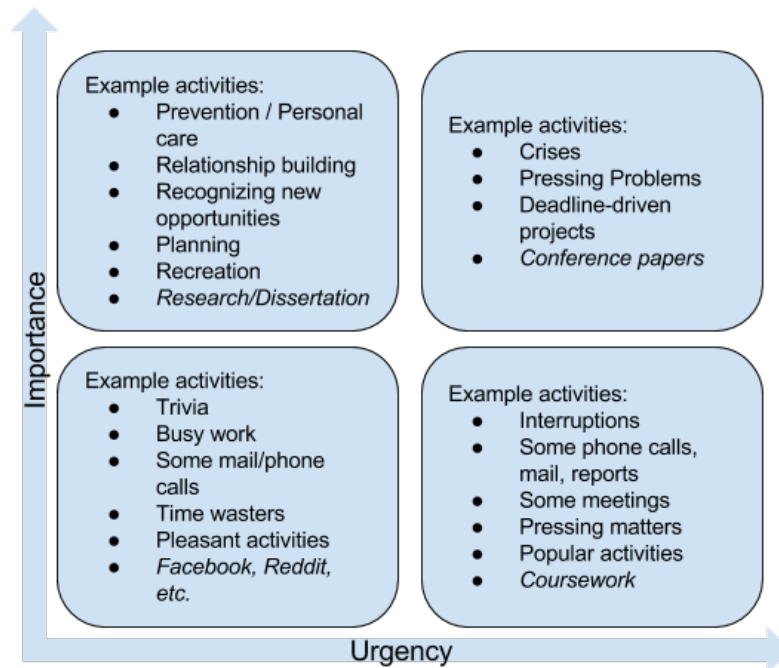


Figure 1: Quadrants for prioritization.²

right time to work.

For me, organization has two parts. The first is making sure I know what I need to do and when I need to do it. I keep meticulous to-do lists and set reminders for the really important deadlines, like conference papers and graduation milestones. I use Evernote¹⁶ to organize my to-do lists and set reminders. I like Evernote because everything is stored in a cloud and is accessible from a mobile app, website, or desktop program. You can set alerts to pop-up reminders on your phone, and the program will email you the morning it is due. I have a writing to-do list and a to-do list for each week of the semester. I also use Evernote to keep notes organized for courses, conferences, and articles from the internet that I want to save for later reference. The other advantage of having detailed to-do lists is that I can usually find things to fill small and large blocks of available time. That being said, not everything makes it on my to-do list: I also abide by the two-minute rule.¹⁷ If a task, like responding to an email, will take less than two minutes, just do it and get it out of the way. The key to this rule is that just completing the task takes less time than it would to mark it to do later and then come back to it.

The other part of being organized is having what you need to do a task. You are not going to be able to execute a task if you spend a bunch of time gathering stuff you need first. I recommend using a citation manager like EndNote or Mendeley to organize your references for your literature review. Mendeley has a quick comparison of all the options on the market.¹⁸ Also, check with your library for more details and possible access to a site license of a paid version of a citation manager. I have used RefWorks, EndNote, and Mendeley. They all function as reference managers, although some are more user-friendly and have more features. A reference manager is an essential tool for every researcher.

The next step in execution is reducing distractions. For me, that meant separating my workspace from my recreational space. I use my desktop for work and my laptop for play. In order to help my self-control, I have also installed a Chrome extension to keeping me from visiting distracting sites on my desktop. Some days, I also leave my phone in the other room while I am working. Computer games, Facebook, and your phone are obvious distractions. However, you should also make sure that your workspace is well lit and ergonomic.

The last part of execution is deciding when and how. Everyone has 168 hours in a week. I found it helpful to sit down and break up how I “should” spend those hours, like about 49 hours of sleep, 20+ hours a week on research (depending on the semester), seven hours for exercise, etc. I have a spreadsheet that helps me break down how I spend my week, which also helps me with prioritization. In graduate school, I updated it each semester based on which courses and assistantships I had. When scheduling your tasks it is helpful to be aware of the times of day you are the most alert. If you are a morning person, you should do your hardest and most intellectually intense activities in the morning. If you are not a morning person, then you should do the opposite. I am not a morning person, so I rarely do writing in the morning.

Habits

The final part of time management is developing good habits. One of the most useful techniques for me is the 20-second rule.¹⁹ Psychologists have found that activation energy is a hurdle we all face when we decide what to do. Generally, tasks that we can start within 20 seconds will get done before the tasks that take longer.¹⁹ The example Achor¹⁹ uses in his book is putting the book you want to read next to the couch and the batteries for the TV remote in the other room. This means it takes less than 20 seconds to pick up the book and way more than 20 seconds to turn on the TV. Use your own activation energy to encourage good habits and discourage bad habits. The other technique I found helpful is the Pomodoro technique. With the Pomodoro technique, I work for 25 minutes and then take a five-minute break.^{20,21} I repeat this cycle until I have completed the task or a time-specific commitment, like class, comes up. I find this technique complements the 20-second rule because 25 minutes is a short enough time to commit to completing and once I have completed the first 25 minutes I’m into the task enough to see the end, which helps me keep working.

Budget

Time management is about creating a budget for the 168 hours each week. Budgets in graduate school come in many forms. In addition to time, I had budgets for both money and my health while I was in graduate school.

Money

The easiest budget to create is for your finances. The bottom line when it comes to money is to create a budget and live within your means. This probably will mean that you need to make some

sacrifices to live on your assistantship stipend, but that is all right, it is only temporary. For example, I did not have cable in my apartment during my Ph.D.; it saved money and removed a distraction.

If possible, avoid taking out (more) student loans. Instead, apply for fellowships. Applying for fellowships also gives you valuable practice writing research proposals and personal statements. You will also need to build relationships with people who will write recommendation letters for you. You may call on them again for letters in your job search.

In the spring of my first year, my advisor and I applied for an internal grant to support my first research project. It was helpful because I got the practice writing a grant and because it funded a research assistantship for my second year that I would have not otherwise had. In addition, because I developed a relationship with the organization that funded my grant, they asked me to help review the proposals the following year. If you can help write or review grant proposals as a graduate student, it is a great experience.

Health

Your mental and physical health should have some priority in graduate school. A recent study at Berkley showed that over 40% of STEM Ph.D. students were depressed.²² There will be emotional highs and lows throughout graduate school. Find what works for you to vent stress and recharge when needed. For some of my friends, exercise (like running or yoga) was helpful. Another friend walked dogs at the humane society each week. I had a combination of games, hobbies (like jewelry and photography), and exercise that worked for me. In addition, do not neglect your physical health. You should eat healthy, exercise, and get regular sleep. I found that all of these contribute to how productive I am during the day. Consulting a doctor, at least for an annual physical, is also important. Locate your campus clinic and counseling office. Do not be afraid to use either if you need them. Preparing for your career

As you are managing your time and budget, find activities to build your curriculum vitae (CV) or résumé. If your goal is to go into academia, you should have teaching, research, and service activities on your CV. If your goal is to pursue a job in industry, find ways to gain experience through internships and identify transferable skills like project management and the use of a particular software or tool. For both career paths, you should also be working to build your network at conferences that you attend.

Start your job search about 18 months before you plan to graduate. I planned to graduate in May of 2016, so in the summer of 2014, I started attending workshops, looking at open positions and drafting materials for my faculty search. I found campus workshops and *The Academic Job Search Handbook*²³ to be helpful resources for a faculty job search. If you can find a workshop series or course that helps you prepare materials and provides opportunities for feedback, that is the best option. While you are preparing your materials, begin seeking candidates to write your reference letters. I have learned that is best to ask a person “would you be willing to provide me a positive reference for my faculty search?” The key word in this question is “positive.” In my experience, people who are on the fence about you will not usually answer yes to that question. Make sure you talk to everyone before you list them on any job application. I had two takeaways

from my search. First, start your documents early and get feedback from as many people as possible.²³ Second, customize your materials to the school to which you are applying.²³

For me the stars aligned, and I was offered a position that I applied for in the fall of 2014 and I was able to delay my start date to January of 2016. However, if that had not worked out, I still would have been able to try again in the fall of 2015. I applied to only three schools early and for each of the positions, I knew someone on the search committee who could give me feedback if it did not work out. This feedback would have been very helpful had I needed to adapt and apply to places in the fall of 2015. I gave myself two faculty hiring cycles so that I would have two reasonable shots at the job market before my desired graduation date.

Conclusions

Earning a Ph.D. is hard, but it can be done. I have summarized some resources that helped me work through my graduate degrees. Unfortunately, this is not an exhaustive list. The key is finding what works for you. Because time in graduate school is less structured, I suggest coming up with a regular routine (that includes your research and personal wellbeing) and stick with it as best you can. However, make sure it is adaptable as you learn what works for you or when you have extra work due to finals and distractions at conferences.

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