



PhD 101

The Manual To Academia

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Introduction

So, you've made it into your doctoral program. Congrats! It's a big achievement. You managed to get through the interview process and secured your spot. The next few years are going to be full of new experiences and it's important for you to get up to speed with your new surroundings and student path.

Entering Academia is daunting for many students. It's a whole world that you might be unfamiliar with. Terms like "journal article", "double-blind peer review", "research campaign", "literature review", and "citations" are thrown around on a daily basis, and you might be left there with your head spinning from all the new information. What's more, these Academic items play large roles in your PhD, so, they're hugely important.

I remember when I first stepped into Academia to do my PhD all those years ago, and I see the same reaction on my new students' faces every year – this glazed-over look washes over your face, and you're left thinking, "What are all of these things? Are they even speaking English anymore??" The look is somewhat comical to see.

This book goes through the different technical aspects of Academia, and your PhD. It goes through:

- How your PhD differs from the other degrees you've completed
- How to get a jump start
- What publications are
- **How to do a literature review**
- **How to write a journal paper**
- **How to respond to reviewer comments and get your papers accepted!**
- **How to present at a conference**
- and more...

After reading this book, you'll be up to speed with the academic technical items pertaining to your PhD and Academia itself. What's more, you'll be able to understand all those academic conversations that go on in your department.

Let's begin!

What Is A PhD?

A PhD is a process whereby someone of a particular skillset is taken and trained to be able to conduct effective and efficient research in a given field. At its crux, it's as simple as that.

At the start of your PhD, you only need to have the skillset required by entering students. By the end of the PhD, you should have developed the skills of a researcher.

The PhD focuses on a particular “question” – that question is what your PhD is aimed at answering. For example, the question might be something along the lines of, “What is the effect of temperature on Li-Ion battery charging times”, or “What is the effect of inflation on small business growth”. The question needs to meet the following requirements in order for it to be worth investigating:

- 1) Important to the funder
- 2) Well-, and precisely, defined

3) Relevant to your field

The first requirement is perhaps the most important of all; the research you put out should benefit the funder in some way. What that benefit is, is usually determined by the funding body. For example, the funding body might be the environmental agency, and they might want to understand how water vapor affects the “glasshouse effect”. So, your PhD research should provide information about that kind of phenomenon. Another example could be a pharmaceutical company, which is looking at a new kind of drug. If the research you plan on conducting doesn’t benefit the funder, then that will impact the future grants to your research group – it might even affect your funding during your PhD, as you will probably have some kind of annual review. It might seem daunting, but your supervisors are there to guide the direction your PhD takes, so you shouldn’t be left to your own devices.

Catering your PhD research to the funding body’s field might seem very difficult, but with practice, it is quite easy. Some questions that you have to ask yourself are:

1) What does the funding body do?

2) What direction is the funding body going?

By answering these questions, you'll get a much better idea of whether the research you are doing will be beneficial for them or not – align your research with the answers to these questions and everyone will be happy. What's more, your project will already have a general direction defined before you start, and so you'll already be fairly dialed-in to what the funder wants. It's just a matter of tweaking that direction to really hone-in on a particular goal and making sure that it still fits what the funder is after.

The second requirement is also important. The more defined your question is, the more impactful your research will be – if you conduct a few experiments or simulations, and they all aim at slightly different questions, then it will be difficult to show how your research is applicable – a little here and a little there means that the data you collect are in all different areas, but they don't really work together to give you a cohesive body of work. By having a well-defined question, your work becomes greater than the sum of its parts; each set of data you collect joins the rest of the data you have, to provide even more insight into a particular phenomenon. Furthermore, the more you work on a particular

question, the more knowledgeable you become about it, so every subsequent experiment or simulation will be better, it will be more effective and efficient. On the other hand, if you have a broadly defined question, then you can't really answer it, as it requires a lot more work to give conclusive answers – your work will be a little more superficial, as you spread yourself too thin. By keeping the question pinpoint accurate, you reduce the amount of work you need to do, and increase the applicability of the work you do.

The third requirement is also important as if your question is different to your field, then you might not have access to the knowledge you need to successfully answer it – no one in your research group can help you either. Questions that are partly relevant to your field, but also relevant to other fields are grouped into the “multi-disciplinary” category. It means exactly what it sounds like – it contains aspects from more than one field. These projects are very useful as having greater connectivity among fields increases innovation – you'd be surprised how often something from another field (sometimes, completely unrelated) can help another field. For example, some fields are very mature in error analysis (determining what the error is in your measurements), while other fields don't even consider errors yet. Multi-disciplinary projects can be thought of

“cultural-exchanges” – you learn from each other, and the entire project becomes better as a result. What’s more, these days, many applications involve more than one field, for example, marketing is greatly helped by machine learning. So, involving more than one field in a project usually makes the project better.

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Literature review

We discussed publications, how they come about, what they're for, and which ones are reputable. It's now time for the literature review.

The literature review is incredibly important (it underpins your whole PhD), and is fascinating. You see, the idea of the literature review is so simple, yet, so many struggle to understand what it is. I was the same.

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The two problems were:

- 1) I was *subjectively* reviewing the literature.
- 2) He wasn't even reviewing the literature.

99% of people who have trouble with their literature review have that trouble for one of the above two reasons.

To understand what a literature review is, we first need to understand what we wish to achieve by doing it.

At the end of the literature review, the goal is to identify gaps in the knowledge-base of a particular field. It's that simple. The reason why you need those gaps is because you need to formulate "the question" – the focus of your research. If there are no gaps, then what are you researching?

Now, at the start of the literature review, we don't have much. We don't know what has been done in the field, what trends and findings have been reported on in the past, and hence, we don't know what still needs to be

done. So, what we have to do is get from “A” to “B”; “A” being not knowing anything about the field, and “B” being having a question to research.

To do so, **you do the “Literature Review”, which means that you go through all of the publications on that topic, read them, digest the information in them, make notes about the method each paper used, the findings, any limitations, then report on them and highlight the gaps.**

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Writing A Journal Paper

Earlier in the book, we went into what a journal paper was, what it means to have a published journal paper, and the stages of the publication process. This was important so that you could better understand a literature review.

It's now time to learn how to write a journal paper, as you'll undoubtedly need to write at least one during your PhD.

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The hardest part about writing a paper is the start; “How do I start? Do I just start typing and hope that something good comes out? Do I start with the abstract, conclusion, introduction...?”

One of the hardest things for students to do is to silence that little voice in their head telling them that it has to be hard. Nothing ever said that a journal paper must be difficult to write. In fact, the exact opposite is true. Just follow your instincts. Writing a paper is highly intuitive. All of those questions come from overanalyzing the situation, which comes from believing that it has to be hard. Trust me, it isn't. Let's go through it logically to show that there's nothing super-difficult about it.

To start writing a paper, you must first have something to write about, right? If you don't have anything to write about, then there's little point in writing anything. Following that logic dictates that you must have some data processed. Therefore, the first step to writing a paper is to process your data and analyze it. Find the trends. Determine the explanations for the phenomena that you found. You need to be crystal-clear about this information because it's the *foundation* of your paper. Without this data, the paper will crumble. So, you need

to have all of your data ready, all of the trends highlighted and written out succinctly.

From here, you need to determine how these trends and phenomena work together. Which trends naturally group together to answer a particular question? Which ones don't? Once you've identified these groups, most of the hard work is done.

The next step is to figure out which trends (or groups of trends) to include in the paper – the general idea is that each paper focuses on one main idea, so if you have a few groups of trends that feed into different ideas, then you might want to split them up into separate papers. The problem that sometimes occurs here is that if you don't have enough data to split into more than one paper, you'll be stuck trying to make a paper out of a mish-mash of data. If you've done your planning carefully before the research campaign, then this is not usually an issue because you already know what type and amount of data you're going to get; the only time that this usually becomes an issue is when someone doesn't like publishing negative results. There's a bad stigma about negative results in Academia – most people think that if your results don't give something positive, then they're not worth looking at. People who think like that are not

“all there”, they’re not looking at your work from a project management point of view. Let me tease this out more; when you have your own research going, you’ve pulled in grant money and you have a project to complete, would you be annoyed (or worse) if you found out *after* conducting the research (and having found out yourself that it gave negative results), that another group somewhere around the world had done the exact same research a few years earlier and didn’t publish their negative results? I’m guessing you would. So, one of the major reasons why negative results are just as important as positive ones is that, it results in the scientific community using their resources more efficiently. Now, I know that some people will say, “Yes, but why would I give my competition help?” You can think of it that way if you wish, or you can think of it as: you get more citations – if you publish your negative results, then that closes avenues to pursue when thinking about what to research. In other words, every literature review that is done on your niche will invariably touch upon your paper. That means more citations – they’ll use your paper as justification not to investigate a certain question, as it will lead to a dead-end.

I (John) always publish my negative results, and I’ve been a big believer in it since the very start of my research career. To my surprise, the papers with negative findings

haven't suffered any loss in citations compared to my "positive" papers. In fact, in some cases, they've gotten more citations. I didn't understand why that was the case until I started digging through the papers that were citing my paper. What has ended up happening is that, my negative papers have created new niches in my field – many researchers have read my negative papers and wondered whether my findings will hold true under slightly different conditions. As a result, they've investigated it, and my negative papers have served as the backbones to their papers – as a result, I get more recognition. When I first started publishing these negative findings, I didn't expect them to have this effect, I just wanted to make sure that the data didn't go to waste (I wanted to salvage as much as I could), but it worked out far better than I ever could've expected.

When you've determined how to divvy up your results and trends, it's time to start writing the paper.

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Let's go through how to write each of the sections in your paper. We'll go in the logical fashion from introduction to conclusion, then the abstract.

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