

sciences mathematical research in postgraduate A guide to

Introduction

Right now you are probably thinking "My undergraduate studies went well, so why on earth do I need to read this?" Many of the study skills and attitudes that enabled you to succeed at undergraduate level will remain valuable. However, a good first degree is a good example of a 'necessary but not sufficient condition' for success at postgraduate level. There are significant differences. Exams play a far less significant role, but nobody spells out any longer what you have to do. You need to take far more responsibility for the strategy as well as the minutiae of the work. This guide, based on <http://people.brunel.ac.uk/~mastmmg/ssguide/sshome.htm> (denoted SSG below), seeks to help you avoid getting lost during what should be a challenging, but immensely enjoyable, experience.

Many of the issues raised here are explored in detail in "The research student's guide to success" P Cryer, Open University Press and "How to get a PhD" E M Phillips and D S Pugh, Open University Press. See also <http://www.engageinresearch.ac.uk/>, a useful guide to the structure of a thesis at <http://dhost.info/pingke/P-MA-TypicalThesisStructure.htm> and <http://www.missendencentre.co.uk/links> where you will find accounts of doing a PhD written by the students themselves. This guide attempts to filter and map this general advice specifically to mathematics postgraduate research.

Why do postgraduate research?

This is a deadly serious question and you need to answer this honestly. Bad reasons exist, for example, because I want a PhD. The point here is that whilst it may seem like a goal at the start of your studies, at the end you'll be asking "what next?" So it's really important to **enjoy the process** here, and not simply want the product. The best reason is that you are interested in mathematics and want to make a contribution to the field; other reasons may be valid, but if this reason is missing from your list, give this guide to someone else and do something else with your life!

Doing postgraduate research is not a ticket to a job and only academia or high-tech research companies will actually require a PhD. Although the generic skills you develop during your research are sought after by employers, the taught MSc is usually the best way to acquire/enhance specific skills for most jobs, often undertaken when working for the company.

Most PhD positions are advertised at <http://www.findaphd.com/>. Before applying for postgraduate research you will need to ask yourself why you want to do it in that particular area, in that

particular university and with that particular supervisor. This will involve some research e.g. talking to existing postgrads, academics other than the proposed supervisor (e.g. your undergraduate tutor), sorting out practical arrangements such as accommodation, your family and money commitments, whether or not you can work as a RA (research assistant), demonstrator or GTA (graduate teaching assistant) and if so whether these commitments will allow enough time to carry out your own research.

Money

Think of the PhD as a full-time job and act accordingly. Working your way through a (full-time) PhD or MPhil is not feasible unless you are very disciplined and you work less than 10 hours per week. You do need time to enjoy yourself too, maintaining a sensible work/life balance so you will need either a loan or a bursary for all three years of a PhD. Beware of taking a job at the end of the three years but before you have finished the MPhil or PhD - this is an excellent way to ensure that you never submit your thesis.

On the other hand, teaching undergraduates for a few hours per week during your PhD is very beneficial; you gain much needed money and experience, underpin your own understanding of the basics, and you get a sense of achievement even when your research is temporarily stalled. Take advantage of some teacher training sessions if possible and put them on your c.v. You need to watch out though, since it's easy to be side-tracked by undergraduates, and proper preparation can take as much time as the classes themselves. 4 to 5 contact hours a week is reasonable.

Using English

To write or not to write? In mathematics, one usually needs to prove theorems, write programs and obtain results before beginning serious writing-up: this contrasts strongly with other disciplines, where the act of writing seems to provide a major stimulus to develop the thesis itself. Nevertheless, writing interim reports, summaries of objectives etc will clarify your ideas to yourself and your supervisor, and enable you to develop your writing style to be clear, concise and simple. So don't leave it all to the end!

Your university will run English for Academic Purposes courses. Unless your English is already excellent, attend these. Being able to communicate effectively is essential for your postgraduate studies and subsequent employment.

Most academic and academic-related jobs are advertised in the Times Higher pages are available at <http://www.timeshighereducation.co.uk/>. The HERO website <http://www.hero.ac.uk>, although now closed, does still provide useful links.

What next?

be the principal author of papers based on your work to rewrite in a much more concise format. You can expect to add your work in publication form, which usually involves a collaboration with your supervisor, you should also write in examined again, so not doing so could mean failure. You must address all the points raised; you may not be either way it is essential to do this as soon as possible. This can range from substantial re-writing to mere typos. PhD, or (more often) that some amendments are required. At the end, you will normally be told either that you have the modify the thesis.

They can also take notes for you, especially if you need to have forgotten to mention in the heat of the moment. Questions, and to prompt you for results etc, which you speak unless invited), but can be helpful in clarification of They cannot answer questions for you (indeed cannot speak to your supervisor present. It is usually a good idea to have your supervisor present. What is being asked.

Specific questions of detail will be asked by the External Examiner.

Often these general questions will come from the topic. You will probably be asked questions on basic knowledge in areas related to, but outside, your thesis. Be prepared for the opening question "Please tell me, in future development of your ideas could lead and how this might be done. This is likely to be a request to outline where you think questions weakest features of your research?". A closing your own words, what you have done? or "What are the strongest/weakest features of your research?".

but rigorous, experience. It will usually last 1-3 hours, but will seem significantly shorter.

.. and good luck.

Sign up to: <http://jobs.ac.uk>

The Oral is a defence of your work, not an argument. Your examiners are not out to get you, so it should be an enjoyable, exam.

The Oral

- Discuss with your supervisor whether you should make or chalk.
- Be smart; take a pen and paper and board marker pen (otherwise the examiners may not trust your results).
- Present yourself as logical, organised and honest some of his/her papers if possible.
- Find out about the External Examiner's own work; read and answers on post-it notes.

own copy of the thesis in the Viva, so stick in all questions get and how you'll answer them. You will be allowed your critical eyes, writing down possible questions you might prepare for it by reading your thesis again with fresh in the Viva.

Preparation for the Oral Examination.

Nevertheless you can still fail by a poor performance that you submit a thesis which is marginal or will clearly others are supporting You. Don't, your family and society as a whole are making an investment in you that will

research. See the Set work Section 4.22. Then often result in a solution or suggestion you. This will help you definitely precisely what is stopping you making charts, schedules and plans can again writing or making charts, schedules and plans can have several lines of enquiry on the go at the same time. You may feel unable to make progress. It is sometimes helpful this is unlikely to unfreeze you.

Before you discuss this with your supervisor, try writing up as fully as you can what you have achieved and what is stopping you making further progress. The process of doing you may get fed up or even depressed at some stage, probably about half way through, just like everyone else. Don't lose belief in yourself or what you are doing, lean on your friends and family and get help if you need it from others (e.g. counsellors).

Getting fed up!

What is needed?

Much of what needs to be said about coping as an MPhil or PhD student is common to that for MSc and undergraduate students, especially for the project work described in SSG. There are, however, several features which distinguish postgraduate research (MPhil and PhD); principally you are responsible for the content and management of your studies now and nobody will tell you what you need to do next. In collaboration with your supervisor, you set your own objectives and strategies for achieving them.

To gain an MPhil or PhD you need to:

- be knowledgeable of existing work in fairly closely-related areas (for example, your examiners will not be impressed if you cannot explain the standard theories and principal work in your broad area, explain the basis of anything you have quoted or used in your work, or fail to demonstrate that you have actually read all your references),
- be workmanlike, clear and logical in the development of all your ideas and how you express them. Be honest and objective (especially when you do not achieve the results you wanted),
- be original and occasionally inspirational, having real insight into what you are doing. This does not mean being a second Newton; applying existing theories or using known experimental or statistical techniques in a new area/discipline or with new data is generally sufficient,
- have a thesis; that is to say you need to develop a viewpoint which you can defend and which leads logically to a testable conclusion. This is often best specified by writing clearly-specified research questions and detailing the methodology used to answer them,
- have an open mind to others, making the effort to understand what they are doing.

Note that an MPhil or PhD is not simply a critique of existing work or a literature review (though this is part of it). A major difference between an MPhil and a PhD (apart from length and scope of study) is that you will be expected to go to original research papers in a doctorate, whereas quoting from standard texts is acceptable for a masters degree.

