

Undertaking a Project

Problem understanding

Understanding the issue is key to a successful project. Are you trying to solve an existing problem, offer new functionality to address a human need, or develop a theory that explains something, or trying to understand a new situation, or what? Until you have the problem clear in your head, you'll not make good progress.

To help you achieve this, discuss the problem with your supervisor, read around it, and discuss it with friends, and ensure you know what it is you are getting into. Also take this opportunity to consider what grade you are trying to get: some of you will be wanting very high marks, whilst others will have more modest ambitions: make sure your supervisor knows what level you are aiming for. Make that target a challenging one, but one that is achievable too.

Write down what the problem is, in different ways: you should be able to both create a blog post, a set of half a dozen slides, or a tweet about it. Not that you have to do these things, but being able to is a good indication you have a good grasp of what it is you are taking on.

Writing a literature review

Your report will be a substantial piece of written work that ideally should conform to a number of academic conventions. One of the most important of these academic conventions is the literature review. In short, the literature review is a discussion or 'review' of literature that is of general *and* central relevance to the particular area under investigation.

Often students ask how long a literature review should be. This is a difficult question to answer but your supervisor may be able to give some indication of the approximate length of your literature review. However, don't become pre-occupied with word length: the main thing is that your literature review should capture the general and specific aspects of the literature of your subject.

Why is a literature review necessary?

The literature review is an important device in your dissertation as it performs a number of related functions:

1. It demonstrates to whoever reads the dissertation that the author of the work has read widely and is aware of the range of debates that have taken place within the given field. It provides the proof that you have more than a good grasp of the breadth and depth of the topic of the dissertation - your dissertation gives you the opportunity to show off how clever you are! The literature review is a great place to start, because it should demonstrate that you know what you are talking about because you have read everything that is relevant to your dissertation.
2. It can provide the rationale for the research question in the study. This can be done by highlighting specific gaps in the literature – questions that have not been answered (or even asked), and areas of research that have not been conducted within your chosen field. In this way the literature review can provide a justification

of your own research.

3. It can allow you to build on work that has already been conducted. For example you might adopt a similar methodological or theoretical approach in your work to one that exists within the literature, yet place your actual emphasis elsewhere. In this way you are building on work that has already been conducted by adopting similar strategies and concepts, yet focusing the question on something that interests you.
4. It helps to define the broad context of your study, placing your work within a well defined academic tradition. Poor dissertations often fail to relate to broader debates within the academic community. They may have a well defined research question, yet without placing this question in the appropriate context, it can lose its significance. The literature review therefore can add weight to your question by framing it within broader debates within the academic community.

How do I 'do' a literature review?

Writing a literature review is not as simple as at first it may seem. What follows is a step by step guide on how to go about conducting and presenting your literature review.

1. Generate a list of references

The first stage of your literature review is to collect a list of literature that is relevant to your study.

2. Make sense of your reading

Once you have a list of references for your dissertation, you now have to access and read this material. This process is going to be time consuming because you will be reading a large amount of material. Furthermore once you start your reading you might find that some of the literature is of little relevance to your study. Don't panic, this is something that many researchers and dissertation students go through and is often a necessary part of the process. It is better to read something that is not central to your dissertation than miss something that might be an important and relevant contribution to the field.

While reading, make notes about the central themes and arguments of the book, chapter or article. These notes can then be incorporated into the finished version of your literature review. Try and get a sense of the theoretical perspective of the author, this will be of use when you come to organise and present your literature review. Also, emphasise the way in which the piece of literature you are reading seeks to set itself apart from other literature. Importantly, start to think critically about the piece you are reading; ask: what is this person trying to say and why? How is it different from the way others have dealt with this issue? This critical component is very important as it demonstrates that you are engaging with relevant literature in an appropriate manner and that you can discriminate between different perspectives and approaches that exist within your chosen field.

3. Organisation and presentation

Once you have generated a large number of notes around your reading you might start to feel overwhelmed by the literature. In terms of the organisation and presentation of your literature review, it is worth dividing your review into two main areas: general reading and literature that is of central importance. You will also need to further divide the literature into specific areas relevant to your study for e.g. theories and concepts; policy analysis; empirical studies and so-on. What follows are some general guidelines on how you might do this.

General texts

It will be clear that some of the reading you have done is of more relevance than others. It is important, however, that you do not discard the less relevant work; instead this can form the broad background of your discussion of the more relevant literature within your field. For example you may mention different authors that have dealt with a question related to your field but may not be central to it. Highlight these in broad terms, state how these works have impacted on your particular area. You need not go into great detail about these more general works, but by highlighting these works you are demonstrating your awareness of the scope and limits of your study and how it touches upon other areas of study.

Central texts

Once you have discussed the range of literature that is only of general interest to your study, you can then go into more detail on the literature that more sharply focuses on the questions that are of interest to you. Devote more detail to these particular works as they are more important to your topic. Indeed they may highlight the gap in the literature that exists that you seek to fill; they may provide the basis on which you seek to build, or they might be works which require some critique from your particular perspective.

Further categorisation

When you have divided your literature review into general works and works of central importance, you should also further divide the literature into sub-categories. By further dividing your literature in this way, you are adding more organisation into your literature review by providing specific sub-categories of relevant literature.

For example in the general works section of your literature review, you might want one sub-heading on the main theoretical debates, one on empirical studies and maybe one on policy. With reference to the more central literature, you could organise this more important reading in a similar way. For example, if relevant, you could have a section on competing theoretical perspectives; a section on the main findings of important empirical studies; a section on policy implementation and its impacts. See the table below.

Breakdown of Literature Review

General	Theoretical Approaches
Literature	Empirical Research
	Detailed analysis of theoretical and conceptual debates
Central Literature	Discussion of main findings of important empirical studies and their critiques
	Focused analysis of key systems and experiments

If appropriate you might also want to divide your sub-headings further.

One final note on the more central literature is that this more focused analysis can also serve to bring your

empirical or theoretical work into sharper focus. In this sense you are prefacing your work and how it relates to other academic studies by your discussion of it in your literature review. One thing to remember however is that just because you talk about an author's work in your literature review, doesn't mean you never mention it again in your dissertation. In the discussion section of your study you will necessarily relate your findings to those central studies that you have highlighted in your literature review.

A good literature review structures the field and relates different work together: you should try to think of your review as providing a framework and background to the specific domain you are investigating. Because of this, literature reviews often have summary diagrams, tables or checklists in to show the relationship between different elements.

Then what?

When you have written your literature review, this is not the end of the process. Throughout your dissertation process, you will come across literature that is of relevance to your area of study, do not ignore this material, you can always add more literature to your review as you come across it.

Finally, make sure that you keep a record of all your references, even the ones that have been of little use. This will help you organise your bibliography and reference list. You may even need to go back and look over something that you looked at earlier in your studies that may have more relevance than you first thought.

Tools to help

You should use tools to assist you: writing should be done in word processors that work well with references managers, such as Word or LaTeX. You should be fluent in using Google Scholar, the online libraries the University has access to; you may find social resources such as Mendeley and citeulike useful to generate more possibilities to look at, and are strongly advised to store your references in a reference manager such as BibTeX, Mendeley, EndNote or other such tool.

Adapted from the University of Birmingham's [General Guide to Writing a Dissertation](#), [Online] (Accessed 4th September 2010)

Software/solutions review

Much like the literature review, this focuses on what previous attempts to solve the problem have been, in terms of software tools developed, apps created, and suchlike. Depending on the area of the project, this may be much shorter or much longer than the literature review, but it is typically shorter and more focussed.

You should ensure that you explore existing solutions so that you don't replicate what others have done, but instead can learn from them, sometimes taking the best bits and combining them, sometimes realising that the approach taken is completely inappropriate. Make sure you cover both commercial systems (free and paid), typically in the App or Google Play store, and research systems, often not released directly but reported on in the literature, possibly available from research groups' home pages, and so on. Presenting the systems, key snapshots of the system and details of how it works are useful, as well as what it actually does.

Hypothesis generation

A good project tries to come up with a clear formation of the problem that is to be solved, based on the literature review and software review that has been conducted.

This is similar to understanding the problem, but whereas the problem space might be very broad, the hypothesis should be something that is a simple, clear formulation of a much more specific problem, and one that can ideally be explored and investigated in the remaining time of the project.

A hypothesis should be a single statement: if you want to investigate a problems with more than one angle, then try to develop a number of separate hypotheses that can each be tested.

For example:

Hypothesis 1: people find it difficult to focus on a task because they are distracted by Facebook and because they are hungry or thirsty, or because they are stressed.

This is a poor hypothesis - whilst it does define the problem space, it is something that, even if you proved it to be true, doesn't tell you too much - if they do find it difficult, would it be because of Facebook, their nutrition needs or emotional state?

Prototyping

If you are planning to create code, then you're almost certainly going to want to prototype your ideas.

Prototyping can be done using:

- paper and pens
- Powerpoint
- Photoshop
- Balsamiq

or a range of other more specific prototyping tools.

Quick code can also be used for more advanced prototyping, often investigating one aspect of the approach whilst ignoring others.

The point of prototyping is to try out a range of options and ideas very quickly and with minimal cost in time or effort. You should explore the design space using prototypes until you have a pretty good idea of what the system you are to create will act, look and feel like.

Code design

Too many people write code first, then work out how the architecture of the system fits together afterwards. It is, in the end, much quicker and much more professional to design the basic infrastructure and concepts first, then

code them afterwards.

You can code in whatever language you choose: we teach and tend to expect you to use Java (either for desktop/laptop machines, or a version for Android mobile phones) but you are free to use any language you wish. Note that support for programming is more readily available in Java, but it is not the role of your supervisor to help you with programming issues.

If you have problems with code, use Google, stackexchange, and the support of friends and colleagues: working with others really helps you improve your code. Remember that the code needs to be your own creation, however, and if you get substantial help on parts then they need to be acknowledged in the write-up else you may be subject to problems around plagiarism.

Coding and testing

No-one gets good marks for writing code: the code has to serve a purpose and test some ideas or try out some concepts.

However, you should write effective, efficient code, and refactor it as necessary. It is also important that you have tested the code in terms of modular tests and overall testing, so that you know it does what you expect it to.

But also remember that this is experimental, project code, not hardened commercial quality, and so it can be different to the sort of code that a fully-featured, publicly released system would be like. Remember, it is there to serve a specific purpose, and as long as it does that effectively, reliably, repeatably and coherently, then it will have achieved its aims.

You do not need to provide large amounts of code in your report, but it should be accessible in your file space, though any parts that are especially pertinent, or clever, should be included and explained.

You are reminded that using GIT as a repository is important.

Evaluation

Your code or app will have been created to address a problem or investigate an issue: this part of the project puts it to work to see if it does that. It may be that you move into a full experimental trial, in the lab or in the wild, or it may be that you run a few pilot tests to demonstrate its effectiveness as a proof of concept. Whichever route you take, you should be able to demonstrate how your code allows you to gain a deeper understanding of the issues and how it contributes towards answering the hypothesis that you came up with earlier. Obviously, as many new questions as answers may be generated, and you should pull all these together in a coherent discussion.

There are many different approaches to evaluation that you can take: the most effective ones are those that address the research questions and domain you are working in, so talk to your supervisor about what you intend to do to.

Experimental design

If you are taking an experimental route, designing the experiment is a critical element of your project. You should consider carefully how previous investigations were conducted, and assess whether using their approach makes sense for your context - keeping things similar means that comparisons between results are more easily made. If you decide to design your own new experiment, remember that an experiment aims to test something (your hypothesis) and you must ensure that it is constructed so that it does just that. In other words, the variables that you keep fixed should stay fixed, the one (or more) that you vary should be carefully varied so that they cover the range of values you expect, and the results measured should be the ones that you want to see.

Many experiments are designed to test specific aspects of much broader, more complex problems, and so if you are trying to create a set of controlled conditions, please ensure that you continue to keep the situation the same. You risk invalidating your whole experiment by altering what you tell people at the start, or altering the inclusion criteria, or adjusting how long people undertake the experiment for, or whatever.

Some experiments are more 'in-the-wild', with much less controlled conditions available to the experimenter - these are excellent for understanding different aspects of the problem domain, and you should be aware of the limitations and advantages of this approach.

This is why piloting an experiment is so important: the pilot allows you to understand whether the experiment makes sense to the participants, whether it tests what you want, whether you are measuring the right things, and whether it needs fine tuning before running for longer.

You should discuss the details of what you are planning with your supervisor in quite a lot of detail, as getting the experiment wrong means that your results are not likely to be particularly useful, and there may well not be time to rectify the problem.

Experimental operation

Running the experiment may be relatively easy, or quite involved and complex, depending on the situation.

The key elements to remember are that the conditions should remain the same as much as possible, which includes trying to avoid people finding out too much about the experiment by chatting to each other or reading up about what you're doing.

One of the major challenges for running experiments is getting participants to be involved, and you need to give this some serious thought in your experimental design. Some approaches use the internet to garner larger numbers, though with little ability to check on their veracity: other approaches require people to be in the laboratory for a period of time, perhaps more than once, and you need to ensure that you use the time that these people are giving up very carefully, so that their efforts help you collect relevant data to address your research hypotheses.

The data that you collect, whether it is programmatic, observational, numeric or a combination, is very valuable, and you need to ensure you back it up and keep a copy securely. This is particularly relevant if you are collecting data on multiple devices that are not in your possession, such as mobile phones: consider having the data sent

to a remote server at regular intervals as well as being stored in the internal memory of the device.

Data analysis

The data you collect is the heart of the experiment, but without analysis it tells you nothing. You must choose the appropriate statistical approaches to analyse your data, and test your hypotheses. Be aware of the limitations of the statistics you are using, and do not oversell your findings. If you have low numbers of participants, you should be especially cautious.

Be clear in your reporting, so that others can clearly see what you did with the data and how robust the results are. also found appropriate ways to visualise the results, as pictures are meaningful to readers and can make a complex situation much clearer.

Some of the analysis is much more qualitative than quantitative, but you should be as rigorous in your approach to this as with numeric data: be clear in the method you are using (e.g. grounded theory) and present the data in ways that other people who use the same approach would also understand.

Much of the raw data will not of direct use in your report, but you should ensure it is available in your file space and/or in an appendix to the report.

Report

Your report is the culmination of your work. Some important points are below, but you should discuss the report with your supervisor in advance.

- The report should tell the story of your research: what you did, why you did it
- It should discuss alternatives - why you chose what you did, why you did not follow other options
- It should pull together the different sections - your literature review will have highlighted a few key papers and concepts, which would ideally be reflected in the discussion at the end
- Check it for good English, clear grammar and correct spellings. If you are not a native English speaker, check it multiple times and get friends to check it too

Support for report writing:

[Online scientific writing course \(30 mins\)](#)

[Effective learning](#) (especially the Reading and Writing sections)

Academic writing:

This includes guides on:

- [essay planning](#)

- [reflective writing](#)
- [paragraph structure](#)
- [punctuation](#)
- [signposting](#), and
- [referencing](#)

You should also be aware of plagiarism - a guide is here: [plagiarism](#)

