4 A Literature Review

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What is a Literature Review?

A literature review is an account of what has been published on a topic by established scientists. The publications should be in accredited sources such as journal and conference papers. The review should convey the knowledge and ideas that have been established on the topic and also what their strengths and weaknesses are.

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When you are Likely to Have to Write a Literature Review

1. As an assignment, probably before you start your research work for your thesis or project. Preparing a literature review is often one of the first things a supervisor asks a new graduate student to do. It can seem overwhelming, especially when you've had an initial look at the volume of literature or perhaps the lack of it.
2. As part of a longer document such as a thesis or major report.
3. As an initial scoping for possible thesis topics.

Purpose of a Literature Review

To show that you have a good understanding of the background of your topic of research or investigation. To do this, you need to do the following:

1. Give a coherent account of the various areas of research relevant to your topic.
2. Give a historical account of its development. Its history may span many years or very few, if it is a recently developed area.
3. Show that you know who has done the relevant work, by citing at the appropriate points in the text the names of the authors and the years in which the work was published.
4. Show the links between the various areas of the body of knowledge – the correlations, contradictions, ambiguities and gaps in the knowledge.
5. Show the weaknesses of other work and techniques.
6. Provide a summary of available techniques and materials.
7. Show how your work will form an original contribution.

Common Difficulties

1. Feeling overwhelmed by the quantity of literature.
2. Sometimes having to cope with a lack of literature.
3. Getting started. It is often very difficult to know where to look in the literature to get the general overview you need to start.
4. Knowing how broad or how narrow to make your review.
5. Knowing which documents to discard and which to keep. Your understanding increases over time, and it's important not to discard works that initially don't seem relevant. As understanding develops, documents need to be constantly reviewed.
6. Having the mental discipline to constantly re-read documents to gain fresh understanding.

What Makes a Good Literature Review?

A good literature review presents the facts, but in addition it should also go behind the facts. It needs to:

- Show the issues that have been dealt with in the past.
- Show the issues that are currently being addressed and those that need to be.

- Show the correlations, contradictions, ambiguities and knowledge gaps that exist.
- Show the conflicts between competing research groups.
- Give an analysis and commentary that makes it clear that you understand the issue.
- Show that you are imposing your view on the issue.

A poor review is just an account of who did what and when it was done, without comment on relevance and quality. By doing this, you don't show your competence and involvement; you show that you haven't fully understood the real purpose of a literature review. It happens when by making the following errors:

- You believe that it's not up to you to comment.
- You believe that your role is that of a neutral observer.
- You don't understand the topic sufficiently.

General Guidelines

1. **Do not worry about the sheer volume of literature** that you know exists or that your supervisor may have given you a few specialised papers to start you off.
2. **Be systematic**. It is all too easy to jump around when doing a search. You need to be focused and to keep good records.
3. **You are going to have to be cleverly selective about your choice of literature to search for.** At some early stage, you begin to realise that the process can grow exponentially and become unwieldy. Each review paper that you read may have a multitude of references cited in it. Each journal paper will have anything from a dozen to 50 or more. You can't possibly follow up each one.
4. **It is essential to view it as an iterative process.** During the searching, extracting and filing of material, your understanding of the topic will increase. You won't be able to complete it in only one pass.
5. **Steps 1–12** shown schematically in Figure 4.1 give a series of steps designed to enable you to understand the process of searching for material and consolidating it into a literature review.

   The scheme is a simplified version of the real process, which is obviously more complex and iterative.

Step 1: Consult a librarian about searching techniques

If you don't know how to search efficiently, ask for a librarian's advice, and also attend one of the courses in searching techniques that university libraries offer graduate students.

To search efficiently, you will need to know the following:

- **The relevant searching strategies for your topic.** There are many library databases. You'll probably need more than one of them to do an adequate search.
- **How to do an efficient keyword search of the library databases.** A librarian will be able to help you define your subject in terms of keywords. Inefficient choice of keywords and combinations of them can result in a lot of wasted time and effort.

Stages in the process	*The process*	*Notes. Relevant sections of this chapter.*
Step 1 Consult a librarian	Learn techniques for keyword searching of databases	Page 71
Step 2 Consult a librarian	Using bibliographic data management software	Page 67
Step 3 Find books *(possibly no relevant material available)*	Books	Page 67
Step 4 Find current review articles	Review article	Page 67 Material from these will form the general skeleton of your review Review articles should be re-read often during the process of compiling the review to aid understanding
Step 5 From the review articles' *Lists of References,* choose your KEY journal papers, conference papers and book chapters		Page 68 Material from these will form the expanded skeleton of your review
Step 6 From the KEY sources, select the information needed	info info info info info	Page 68
Step 7 Choose your initial topic headings		Page 70
Step 8 Sort your information from the KEY papers into the topic headings	Initial topic headings 1. 2. 3. etc	Page 70
Step 9 Select FRINGE papers by less prominent authors		Page 70 Material from these will build up the outer edges of the review
Step 10 From the FRINGE papers, select, analyse and file under a revised set of topic headings	Revised topic headings 1. 2. 3. etc	Page 70
Step 11 Re-read your original review papers: reassess your understanding of the topic	The processes are iterative. Meanwhile your understanding of the topic will increase.	Page 71
Step12 Start writing the review	Connect all material for each topic. Keep reworking it.	Page 71

Figure 4.1 Schematic of the stages in writing a literature review. The scheme as shown is a simplified version of the real process, which is obviously more complex and iterative.

Step 2: Using bibliographic data management software

Before you start searching for sources, work out how you will keep records of them. Establish what types of bibliographic data management software are available, e.g. EndNote or RefWorks. Free software is also available, such as Zotero or Mendeley.

Invest the time to learn how to use such software to effectively search, record and create a customised *List of References.* The time saved and the organisational capabilities it will give you are well worth the small effort at the beginning of your searching.

Searching for the primary, secondary and tertiary sources. Using the library databases, there are three broad types of sources you need to search for: tertiary, secondary and primary sources.

1. Tertiary sources are **textbooks**.
2. Secondary sources are **review articles**.
3. Primary sources are the original accounts of the investigations, particularly **journal and conference papers.**

Guidelines for searching for these three types of sources are given in Steps 3, 4 and 5 below.

Step 3: Searching for tertiary sources (books)

At the beginning of your search process, look for **tertiary sources**, i.e. textbooks. You won't find the depth of detail that you will eventually need, but they can sometimes be useful in giving an overview of a field. Some textbooks become acknowledged as authorities and can be acceptable as references.

Many libraries have a large stock of e-books; make sure you search these too.

Step 4: Searching for secondary sources (review articles)

Now search for **secondary sources**, i.e. review articles that are as current as possible, written by accredited top scientists in your particular field. Review articles are summaries of information gathered from primary sources.

The *Bibliography* and citations given in your tertiary source books may lead you to the review articles you'll need. If not, ask a librarian how to search for them.

From a good review article, you should be able to establish the following:

- The general overall sense of the topic.
- The areas that are relevant to your topic.
- Who are the most active researchers, and who are the authorities. Those frequently cited are the most prominent.
- The papers that are regarded as the most important and fundamental, i.e. the most frequently cited sources.

Material from the review articles will give you a general skeleton to build on.

Step 5: Searching for primary sources (journal papers, conference papers, book chapters): choosing your KEY material

Now search for the **primary sources.** These are the first-hand accounts of investigation: journal papers, conference papers, book chapters, theses and reports.

From the large number of citations in the *Lists of References* in the review articles, you can now select the KEY papers:

- The most frequently cited **papers** in the review articles.
- The most frequently cited **authors** in the review articles.
- The **titles** that are the most relevant to your topic.
- The **most recently dated**. Later in the process, to show the historical development of the topic, you may need to access papers that are older.

> Material from the KEY papers will form the expanded skeleton of your literature review.

Concentrate at this stage on identifying the KEY papers. If during this part of the search process, you find a paper that doesn't seem to be directly relevant, file it in another place. You may later find that it can become one of your FRINGE papers (see Step 9, *Select the FRINGE Papers*).

Step 6: Select the information you need from the KEY papers

Choose sources that will enable you to answer the following questions:

- How does this topic fit into a broader view of the research area?
- Why is it an important topic?
- What is known about the topic?
- What is ambiguous, in dispute, unknown? Why?

If you are writing a literature review as anything other than a preliminary overview of an area of work, you will also need to answer the following:

- Why do these gaps in the knowledge need to be filled?
- Which gaps do you propose to fill in your research?
- Why have you chosen them?
- How do you propose to do it?

Why These Questions Need to be Answered

It is important that these questions are answered as well as you can because it is very easy to forget how much you know and how little your readers know in comparison. When we forget this, we tend to think that the facts will speak for themselves – that if they are just presented, they will form a coherent account. But they rarely do.

A good analysis of the literature should set the whole context of your work and demonstrate your competence in the area.

1. First read the abstract.
   a. **Prioritise your papers initially by reading the abstracts.** From the abstract, you can establish the paper's relative relevance to your needs.
   b. **Then establish from the abstract which parts of the paper you will need to read.** For instance, if you need details only of the method, it could be a waste of time to read the whole article in detail.
2. Read the relevant part of the paper.
   Then skim-read the rest of the article. From this, you can establish whether there is additional relevant information.
3. Interact with a document: select and annotate.
   Even if you select good material while reading a document, you will probably find that when you come to write it up, you will need to look at the original document again. Most people's memories are far from perfect, and explanatory notes that you made at the time of reading will often not make sense when you come back to them later on. There is always something that you will have overlooked, distorted or oversimplified. Therefore, you will save a lot of time later if you highlight or annotate by any method you like.
4. Classify your key findings under major headings.
   As you gather and analyse your sources, think of the categories into which you can classify them. You can find that each fits into a specific category – or more than one – and that there is some logical organisation taking shape in your mind. As you analyse even more papers, you'll find that your major categories can be broken down into subcategories. Eventually you should be able to pull them all into a coherent whole (see Step 7, *Choose the Topic Headings*).
   The following types of things should be noted:
   - Key elements of the original data and wording
   - An overall summary of the document
   - Key discussion points from the original document
   - Keywords
   - Your own comments and queries

   Make enough notes to jog your memory later.
5. If you find an article difficult to understand:
   Put it aside for a while and come back to it. There are two reasons why you may be finding it difficult:
   1. Your understanding of the topic is not yet sufficient. Later in the process you may be able to understand it with no difficulty.
   2. It may not be your fault that it is tricky to understand; remember that a hallmark of a good writer is the ability to explain even complex topics clearly. If the text seems muddy, it could be that the article is not well written.
      Distinguishing between whether your understanding is lacking or whether the article is poorly written at this early stage can be difficult. Keep the paper and come back to it later.
6. Read all of the important documents at least twice; come back to each one at a later stage in your work.
   You will find extra material and insights in a paper when you re-read it sometime later. At this time, you will have a better grasp of your area of research and of the place of your own work within it. The following are useful things to do at this time:
   1. Note the significant points.
   2. You are probably also now in a better position to check calculations. You may be surprised by the number of errors it's possible to find. You will add depth to your review by discussing them.

3. You may now have the experience to be able to ask such things as the following:
   - Why didn't they do a particular experiment?
   - Is that conclusion sufficiently well supported?
   - Are the statistics weak?

When you have developed more of the depth of knowledge necessary, you may find that the data in some of the published material are somewhat inconclusive. Discussing this in an informed and objective way will add depth to your review.

Step 7: Choose the tentative topic headings for your review

1. Work out the topic headings.

- Do not think that these headings should be fixed. As the review evolves, you will probably find that new topics emerge, and others become less significant or merge with others.
- Make your topics specific. Instead of having a small number of overall, unspecific topics such as 'Issues associated with bacterial adhesion', think of a number of subtopics, each one explicitly stating the specific issue. *For example:*

  Methods for investigating
  Historical background
  Standard techniques
  Current technology

2. Establish either one folder containing these topic headings *or* separate folders for each topic.

If your review is going to be a major work, separate folders are usually more convenient. You will file information under the headings after reading and extracting information from each source.

Under these headings, also note cross-references to various other papers. This saves having to copy large amounts of information; at the final stage of sorting information, you will come back to these papers and extract from them the information needed.

Step 8: Sort your information into the various topic headings

- Your information will come from the following:
  - The material you have placed on file (either in one large folder or in separate ones under various topic headings)
  - The papers' abstracts
  - Your own comments
- Sort your information into the relevant heading or file.
- If some papers span more than one topic, duplicate the material to each heading or into each file. You can decide later where it best fits.

Step 9: Select the FRINGE papers

- These are the papers by the less prominent authors.
- Find them from:
  - The work cited in your KEY papers.

  - Library database searching. From your initial reading, you should now be able to compile the keywords you need for efficient library database searching. If you have problems, consult a librarian.
- Assess the research philosophies, the scientific rigour of the techniques, the results and the interpretations.

> Material from the FRINGE papers will build up the outer edges of your review.

Step 10: From the FRINGE papers, analyse and file the information under headings as you did for the KEY papers

Keep revising your categories for both KEY and FRINGE papers as your understanding of the topic grows. Consolidate them as necessary.

Step 11: Re-Read your original review papers: reassess your understanding of the topic

- You will find that your perspectives will change and your understanding will increase if you approach this as an iterative process.
- Repeat the re-reading and analysis of your review papers and your other important papers during the whole process of assembling the material for your review.

Step 12: Write up the literature review as a final stage

Don't try to write up the literature review before you have assembled all of the information. The more you investigate, the more you will understand about the topic; a review written up too early is likely to need much rewriting.

The steps to take from here are the following:

1. Connect all the material for each topic together:
   - **a.** Take the material under each heading. Sort and re-sort it.
   - **b.** Look for possible subheadings
   - **c.** Look for similarities, contrasts, inconsistencies, gaps in the knowledge, links between the topics and subtopics.
   - **d.** Write the text to link these ideas together.
2. Connect all of the topics together under a series of headings.
   Work out a logical order in which to place your separate topics.
3. Keep reworking it.
   It may take many reworkings to produce a coherent review. The material within each topic and the overall structure of the document will need a lot of work before it is satisfactory.
4. Make sure that the review is not made up of who-did-what-and-when lists, with no comment on relevance and quality.
   For example: Brown (20xx) showed that… and Smith (20xx) found that…
   A good review should provide an analysis and commentary that makes it clear that you understand the issue.

5. Compile the *List of References*
The cross-referencing between your text and the *List of References*, together with the details needed for listing each reference, is riddled with convention. See Chapter 15: *Referencing*, for details.
A data management software package such as EndNote will do this cross-referencing automatically and is well worth using.

A Possible Structure for a Self-Standing Literature Review (i.e. not part of a thesis)

Section	Comments	Cross Reference to Detailed Material
Title	In contrast to the title of most other documents that you may have to write, the title of a review will be a general description of the research area	See *Title*, Chapter 2: *The Core Chapter*, page 19
Abstract	In contrast to most other Summaries/Abstracts that you may have to write, a short *Summary* in a review may need to be a description of the document structure rather than give only informative material. But give informative conclusions if possible	See **The different types of content in an abstract/ summary**, Chapter 3: *An Abstract, a Summary, an Executive Summary, page 55*
Introduction	Provide the following information: • The general historical development of the topic • The various areas of the topic • The document structure in the final paragraphs	See **Introduction**, Chapter 2: *The Core Chapter*, page 28.
Sections appropriate to the subject matter		
Conclusions	Summarise the various conclusions, including any contradictions, ambiguities or gaps in the knowledge	See **Conclusions**, Chapter 2: *The Core Chapter*, page 39
List of References		See Chapter 15: *Referencing*, page 169

Why Your Initial Literature Review Won't Be Good Enough for a Thesis

If you are writing a thesis or another major body of work, your initial literature review – done at the start of your study – can never be good enough to be the version incorporated into your final document.

The understanding that comes through time, the re-reading of the material and the discovery of new material will result in a final literature review that will be very different from your first. Make sure that the review contained in your thesis is written up as a final stage of putting your thesis together.

Supplementary Tabulated Presentation for a Thesis

Consider supplementing the literature review material with a tabulated presentation to summarise the content of each of the relevant papers.

See Chapter 13: *Thesis*, page 143.

Common Mistakes

1. Finishing the literature review before you have fully understood the issue.
2. Just giving an account of who did what and when. An inadequate literature review is one that is little more than a who did what and when list.
3. No obvious logical thread running through the whole review and through each category in it. This can be the result of point 2.
4. Not pointing out the gaps in the knowledge and any ambiguities. Not becoming involved.
5. Referencing errors (see *Common Mistakes,* Chapter 15: *Referencing*, page 188).

Checklist for a Literature Review

- ☐ Does your review show the issues that have been dealt with in the past?
- ☐ Does it show the issues that are being and need to be currently addressed?
- ☐ Does it cite the key reviews on the subject? The KEY papers? The more FRINGE papers?
- ☐ Does it show the correlations, contradictions, ambiguities and gaps in the knowledge?
- ☐ Does it show the conflicts between competing research groups?
- ☐ Does it give an analysis and commentary that makes it clear that you understand the issues?
- ☐ Does it avoid giving just an account of who did what and when?