

RESEARCH METHODS FOR DATA SCIENCE

Assoc. Prof. Dr. Salha Alzahrani
Department of Computer Science

STEP 1: Formulating a research problem

Part I



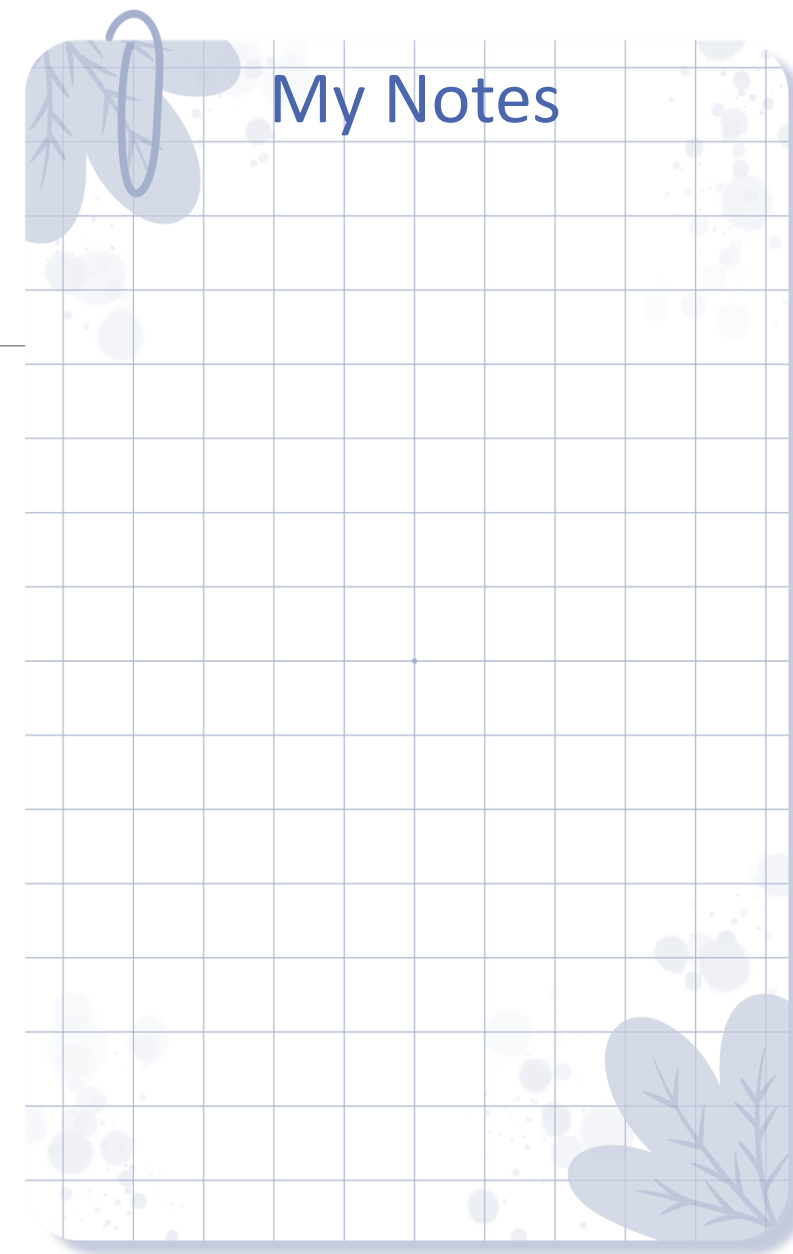
My Notes

~ Literature Reviews

~ Searching
~ Summarizing
~ Presenting
~ Writing

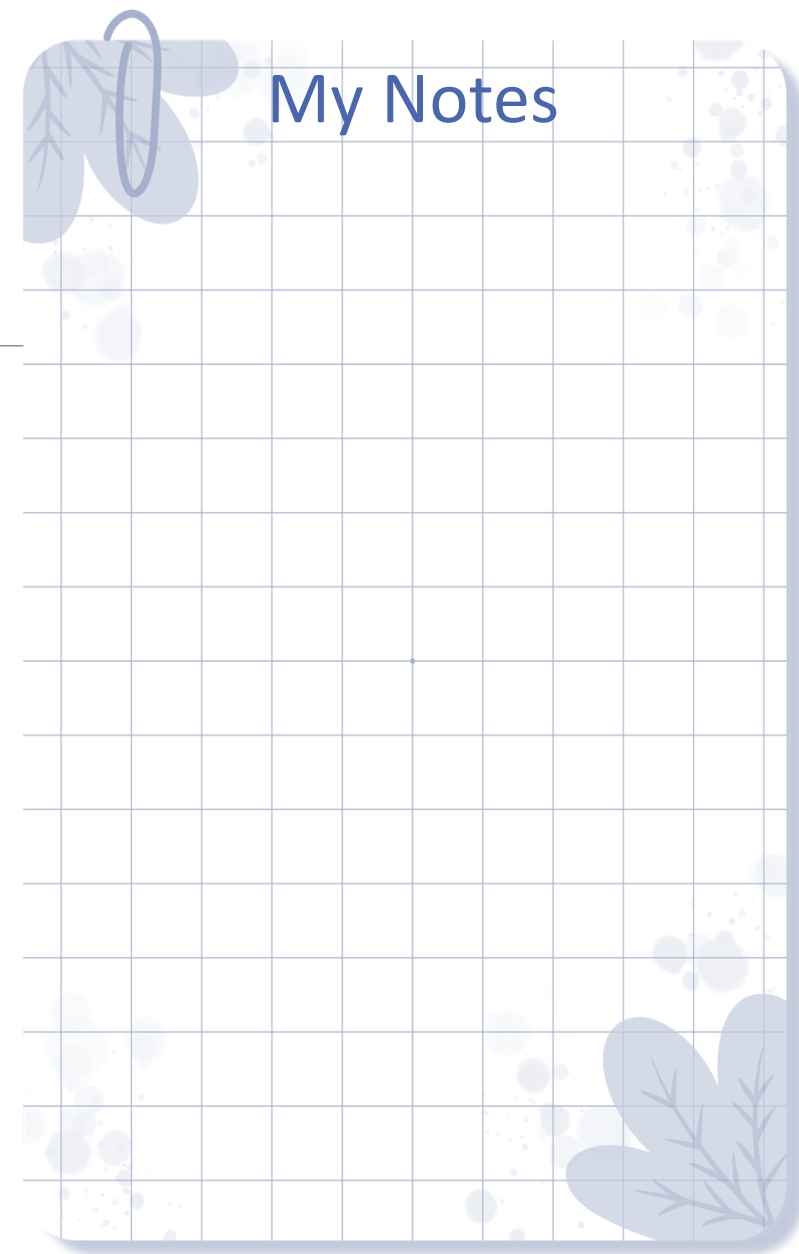
1: Formulating a research problem

1. Reviewing the literature
 1. The place of the literature review in research
 1. Bringing clarity and focus to your research problem
 2. Improving your research methodology
 3. Broadening your knowledge base in your research area
 4. Contextualising your findings
 2. Difference between a literature review and a summary of the literature
 3. How to review the literature
 1. Searching for the existing literature
 2. Reviewing the selected literature
 3. Developing a theoretical framework
 4. Developing a conceptual framework
 4. Writing about the literature reviewed
 5. Summary



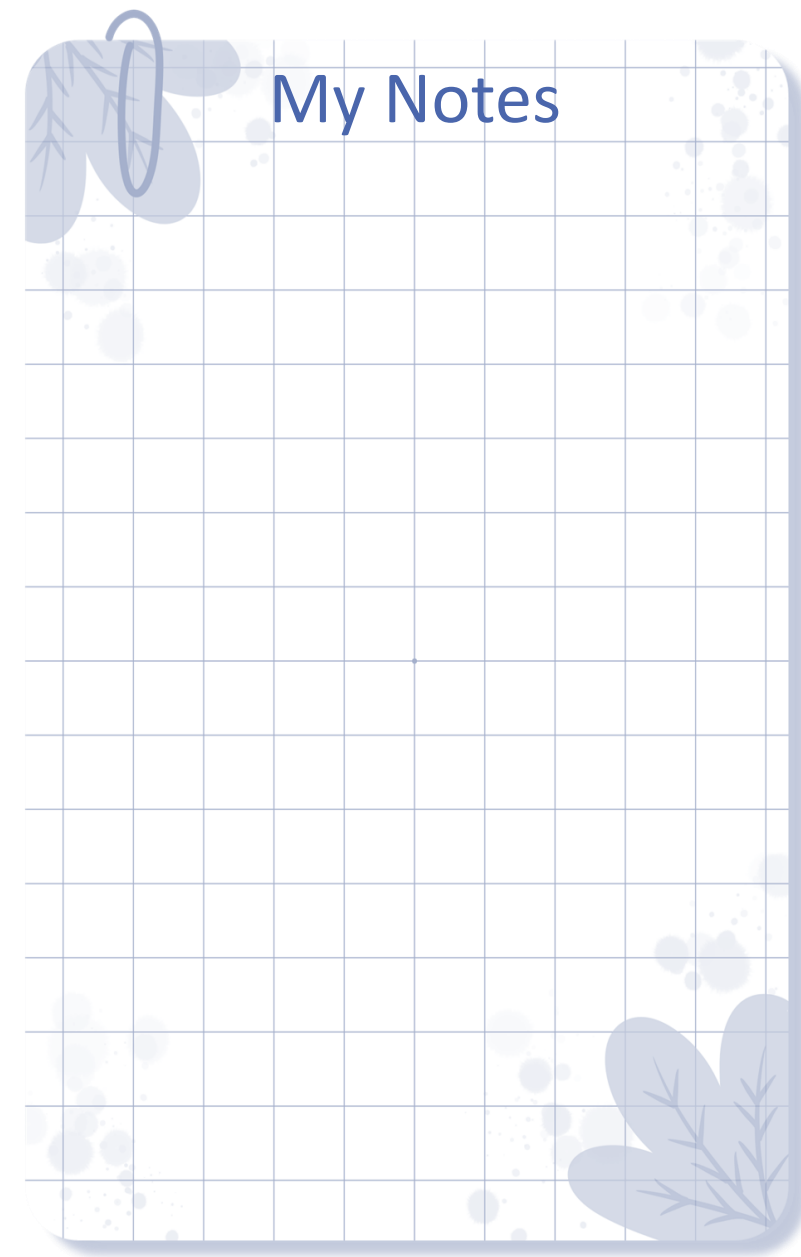
1: Formulating a research problem

2. Formulating a research problem
 1. The research problem
 2. The importance of formulating a research problem
 3. Sources of research problems
 4. Considerations in selecting a research problem
 5. Steps in formulating a research problem
 6. The formulation of research objectives
 7. The study population
 8. Establishing operational definitions
 9. Formulating a research problem in qualitative research
 10. Summary



1: Formulating a research problem

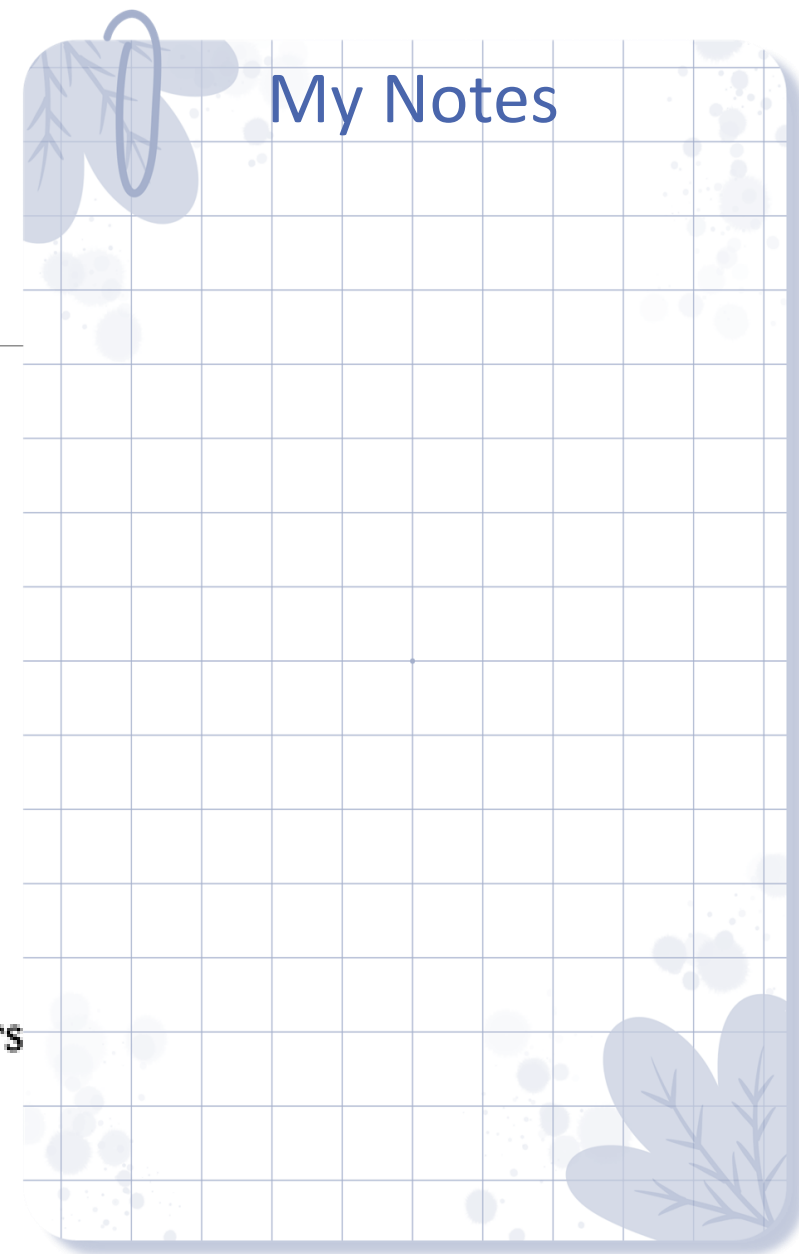
3. Identifying variables
 1. What is a variable?
 2. The difference between a concept and a variable
 3. Converting concepts into variables
 4. Types of variable
 1. From the viewpoint of causal relationship
 2. From the viewpoint of the study design
 3. From the viewpoint of the unit of measurement
 5. Types of measurement scale
 1. The nominal or classificatory scale
 2. The ordinal or ranking scale
 3. The interval scale
 4. The ratio scale



1: Formulating a research problem

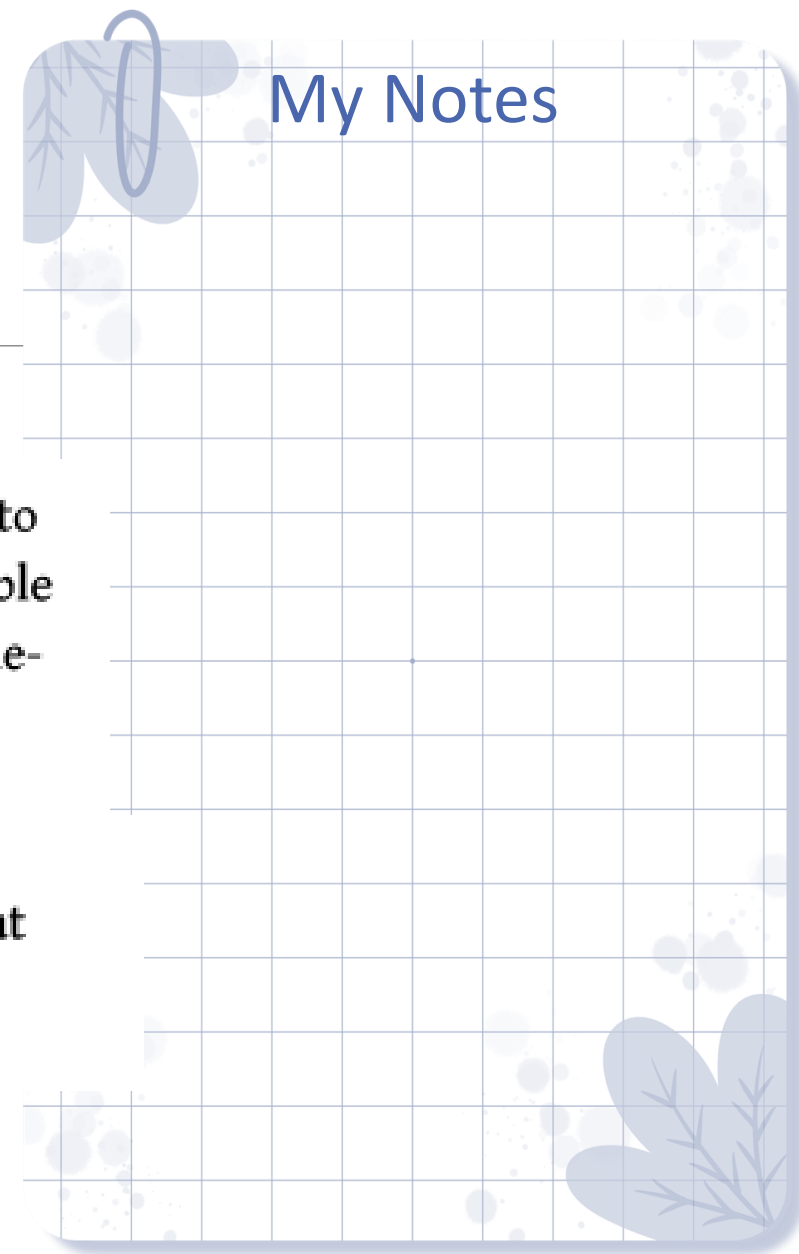
4. Constructing hypotheses

1. The definition of a hypothesis
2. The functions of a hypothesis
3. The testing of a hypothesis
4. The characteristics of a hypothesis
5. Types of hypothesis
6. Errors in testing a hypothesis
7. Hypotheses in qualitative research
8. Summary
9. Developing a research project: a set of exercises for beginners
10. Exercise I: Formulation of a research problem



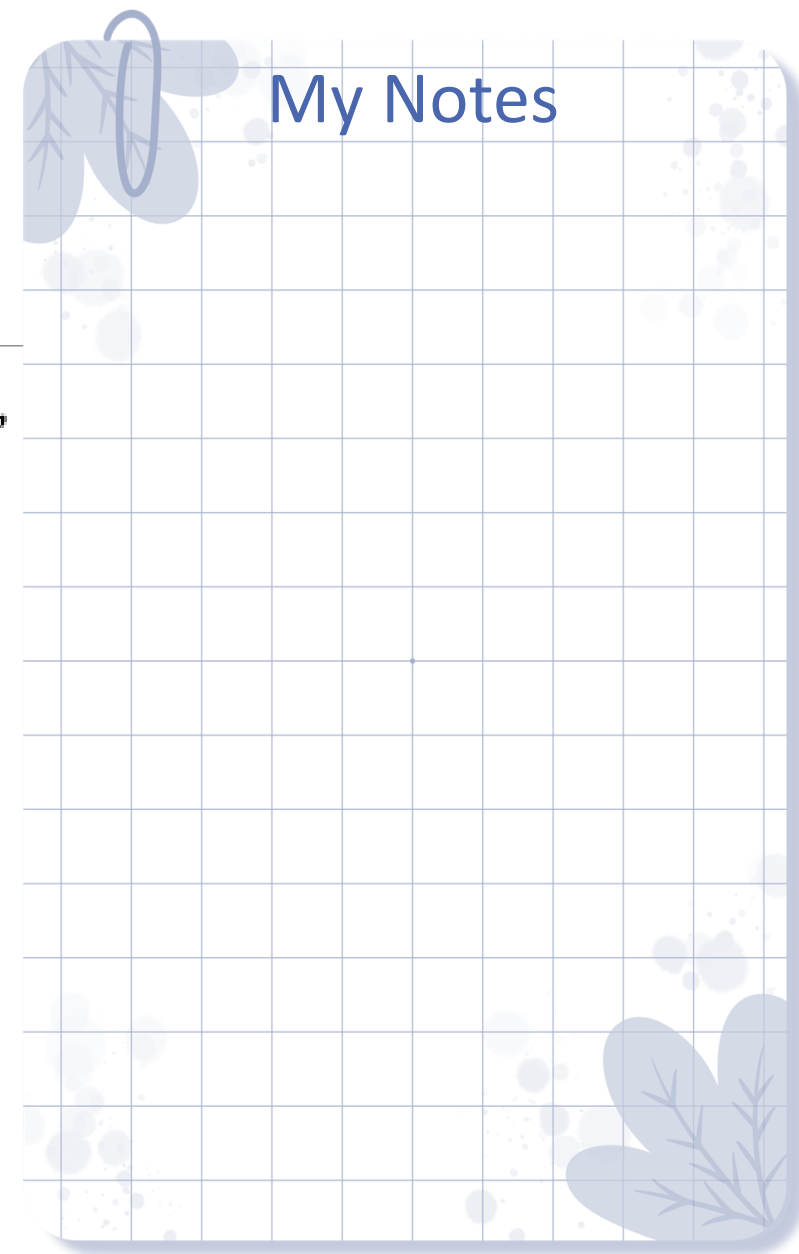
The place of the literature review in research

One of the essential preliminary tasks when you undertake a research study is to go through the existing literature in order to acquaint yourself with the available body of knowledge in your area of interest. Reviewing the literature can be time-consuming, daunting and frustrating, but it is also rewarding. The **literature review** is an integral part of the research process and makes a valuable contribution to almost every operational step. It is important even before the first step; that is, when you are merely thinking about a research question that you may want to find answers to through your research journey. In the initial stages of research it helps you to clarify your ideas, establish the theoretical



The place of the literature review in research

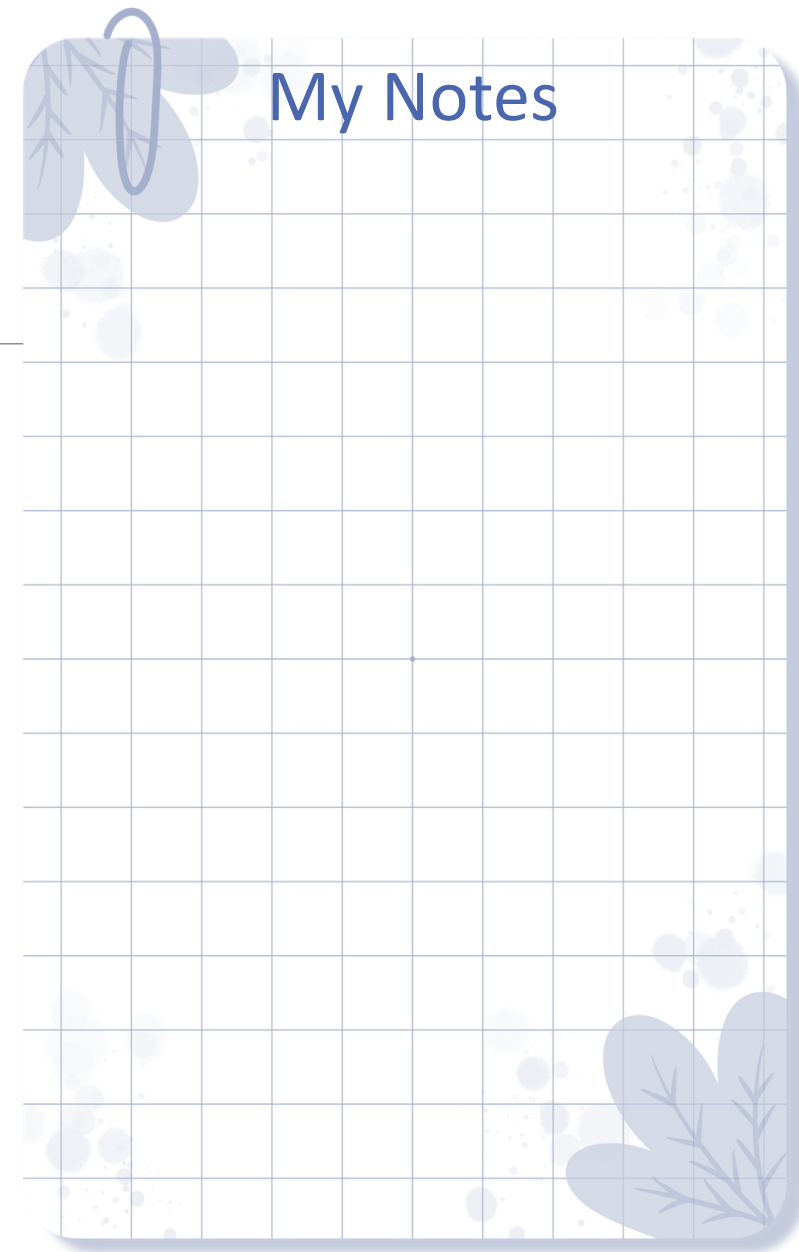
roots of your study and develop your research methodology. Later in the process, the literature review serves to enhance and consolidate your knowledge base in your subject area and helps you to examine your findings in the context of the existing body of knowledge. Since an important responsibility in research is to compare your findings with those of others, it is here that the literature review plays an extremely important role. During the write-up of your report it helps you to integrate your findings with the existing knowledge – that is, to either support or contradict earlier research. The higher the academic level of your research, the more important a thorough integration of your findings with existing literature becomes.



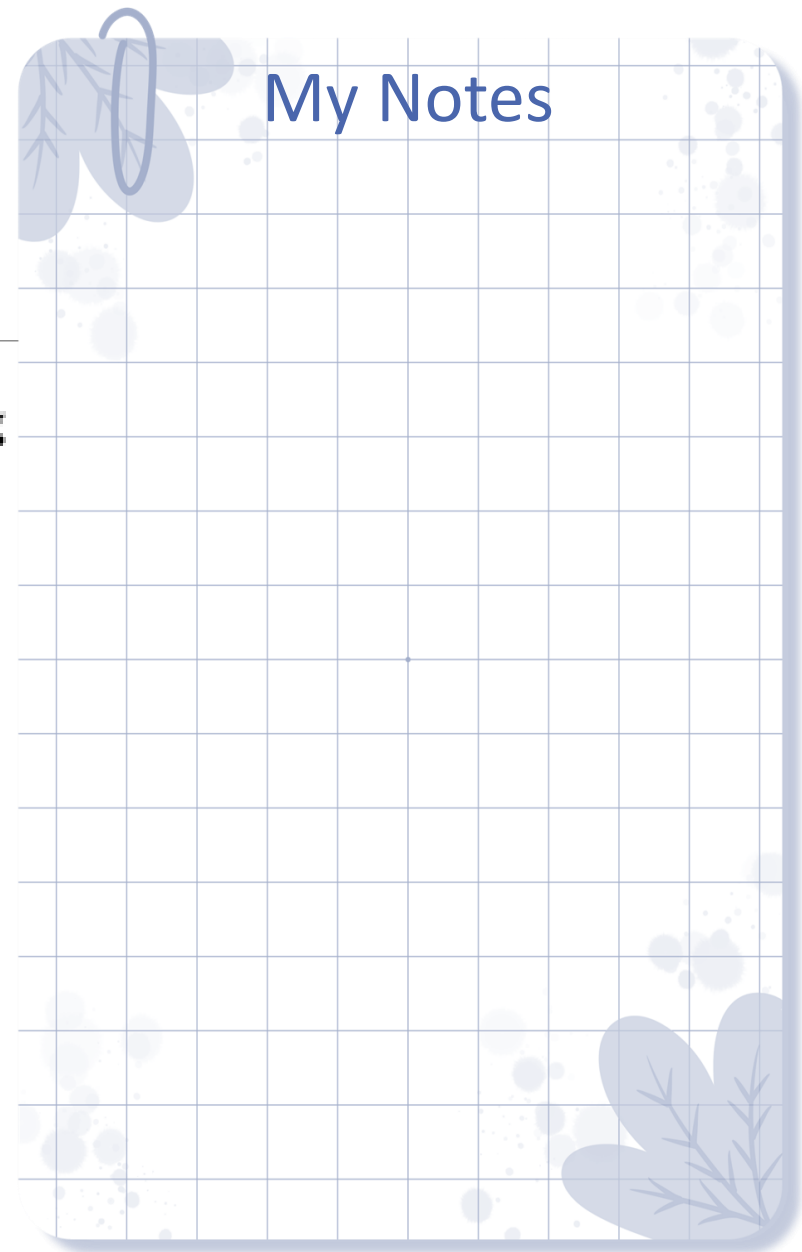
The place of the literature review in research

In summary, a literature review has the following functions:

- It provides a theoretical background to your study.
- It helps you establish the links between what you are proposing to examine and what has already been studied.
- It enables you to show how your findings have contributed to the existing body of knowledge in your profession. It helps you to integrate your research findings into the existing body of knowledge.



So, what is the literature review



Literature review: This is the process of searching the existing literature relating to your research problem to develop theoretical and conceptual frameworks for your study and to integrate your research findings with what the literature says about them. It places your study in perspective to what others have investigated about the issues. In addition, the process helps you to improve your methodology.

In relation to your own study, the literature review can help in four ways. It can:

1. bring clarity and focus to your research problem;
2. improve your research methodology;

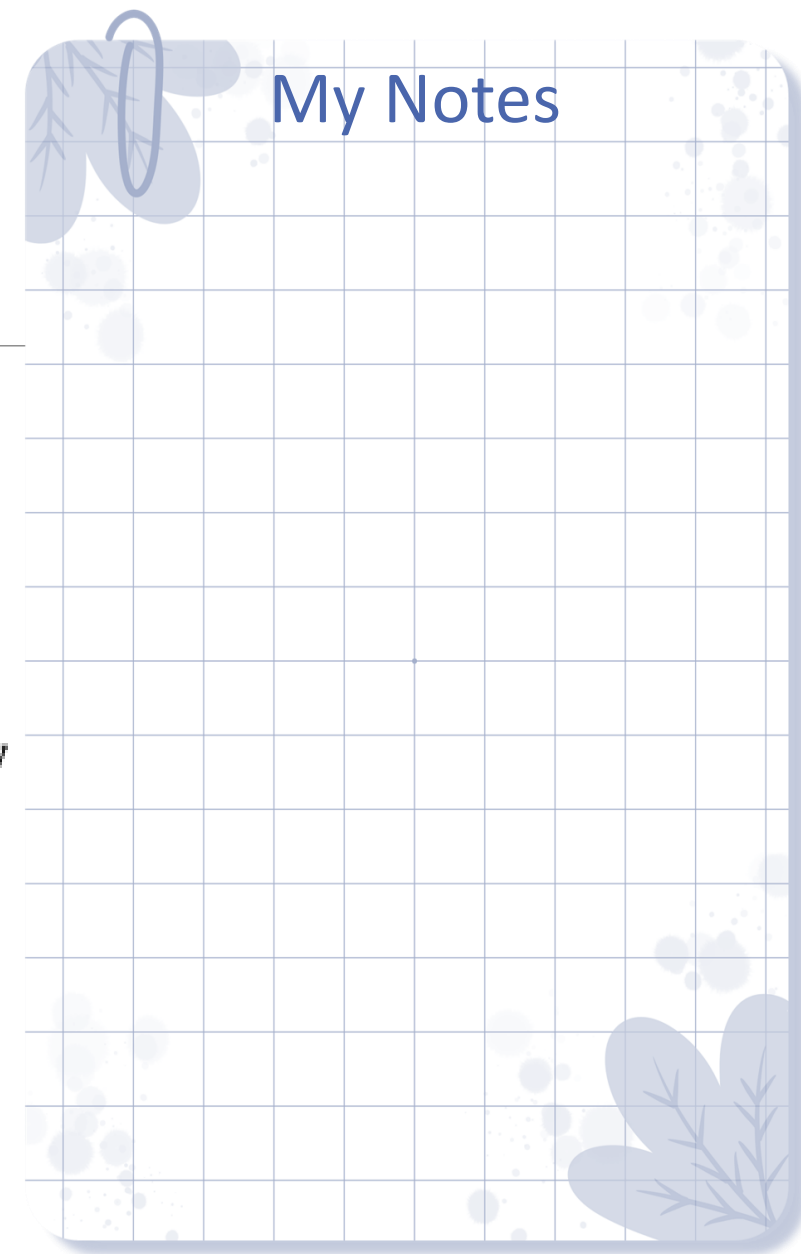
Bringing clarity and focus to your research problem

The literature review involves a paradox. On the one hand, you cannot effectively undertake a literature search without some idea of the problem you wish to investigate. On the other hand, the literature review can play an extremely important role in influencing the nature of your research problem thus conditioning your thinking about choosing your research problem. It is therefore important for you to strike a balance between reviewing the literature and its influence on your research problem. The process of reviewing the literature helps you to understand the subject area better and thus helps you to conceptualise your research problem clearly and precisely and makes it more relevant and pertinent to your field of enquiry. When reviewing the literature



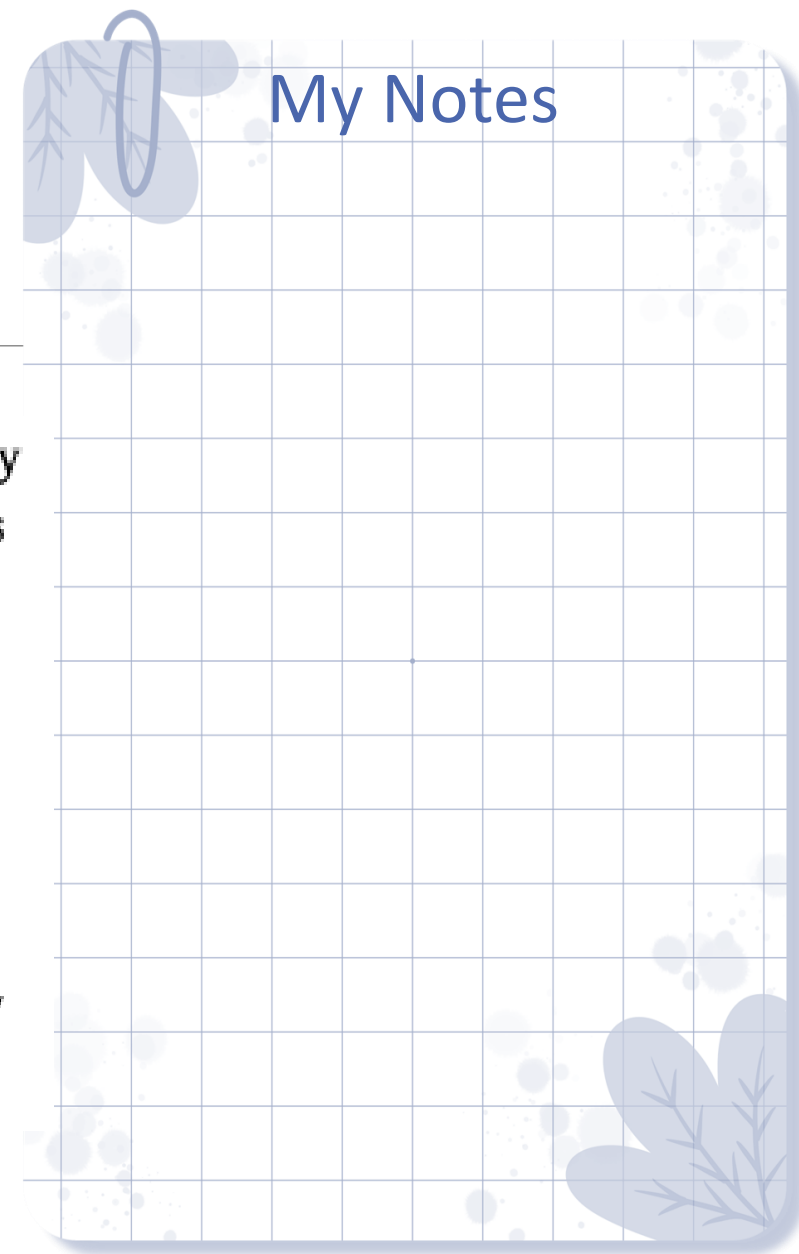
Bringing clarity and focus to your research problem

relevant and pertinent to your field of enquiry. When reviewing the literature you learn what aspects of your subject area have been examined by others, what they have found out about these aspects, what gaps they have identified and what suggestions they have made for further research. All these will help you gain a greater insight into your own research questions and provide you with clarity and focus which are central to a relevant and valid study. In addition, they will help you to focus your study on areas where there are gaps in the existing body of knowledge, and where you can to the existing body of knowledge, thereby enhancing your study's relevance and importance.



Broadening your knowledge in your research area

The most important function of the literature review is to ensure you read widely around the subject area in which you intend to conduct your research study. It is important that you know what other researchers have found in regard to the same or similar questions, what theories have been put forward and what gaps exist in the relevant body of knowledge. When you undertake a research project for a higher degree (e.g. an MA or a PhD) you are expected to be an expert in your area of research. A thorough literature review helps you to fulfil this expectation. Another important reason for doing a literature review is that it helps you to understand how the findings of your study fit into the existing body of knowledge (Martin 1985: 30).



Broadening your knowledge in your research area

My Notes

In summary, in terms of knowledge base, the literature review is extremely useful for it:

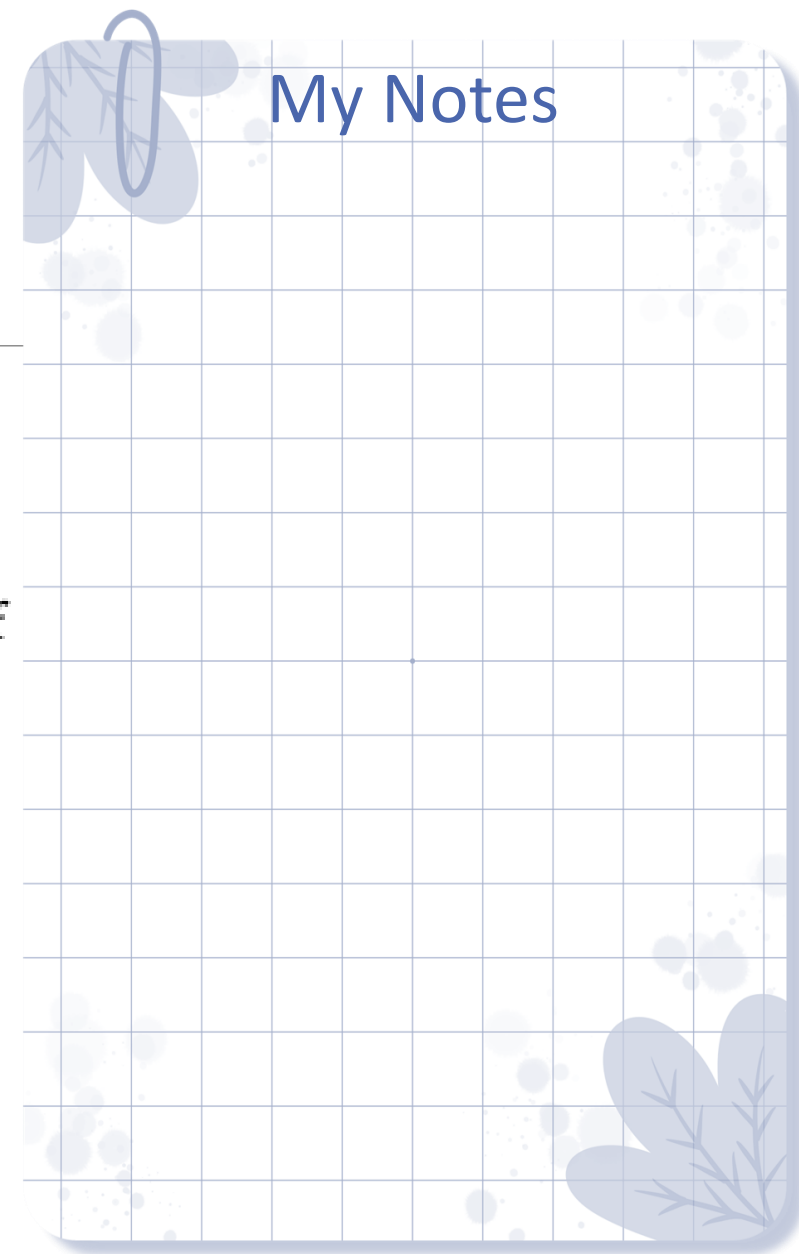
- Helps you to identify what has been established, and what are the gaps in the area of your research, thereby ensuring the relevance and usefulness of your research.
- Acquaints you with methods and procedures used in similar studies, helping you to select a robust methodology for your research.
- Helps you to locate your research questions and findings in the existing literature.
- Helps you to justify the selection of your research questions.
- Helps you to develop, expand and demonstrate your knowledge base in the subject area of your study.

Contextualising your findings

Obtaining answers to your research questions is comparatively easy: the difficult part is examining how your findings fit into the existing body of knowledge. How do answers to your research questions compare with what others have found? What contribution have you been able to make to the existing body of knowledge? How are your findings different from those of others? Undertaking a literature review will enable you to compare your findings with those of others and answer these questions. It is important to place your findings in the context of what is already known in your field of enquiry; that is, to integrate what you have found out with the existing literature.

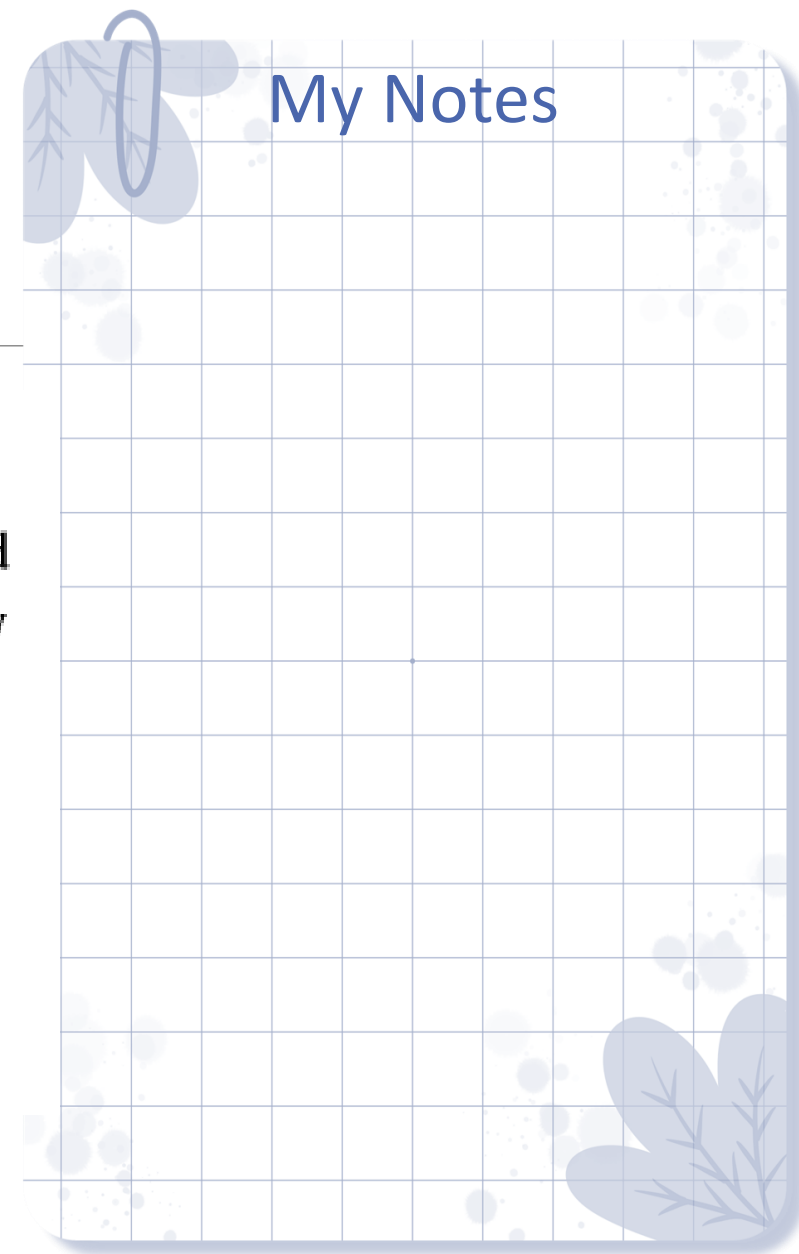
Difference between literature review and summary of the literature

Some people use the terms 'literature review' and 'summary of the literature' interchangeably. However, there is a difference between the two. A **summary of the literature** is a description of the significant findings of each relevant piece of work that you have gone through as a part of your literature search. The summary basically entails listing, under each pertinent source, the major findings of relevance to your study. The sources searched can be listed in any order. However, in a literature review the main findings are organised around main themes that emerge from your literature search. Different studies in which



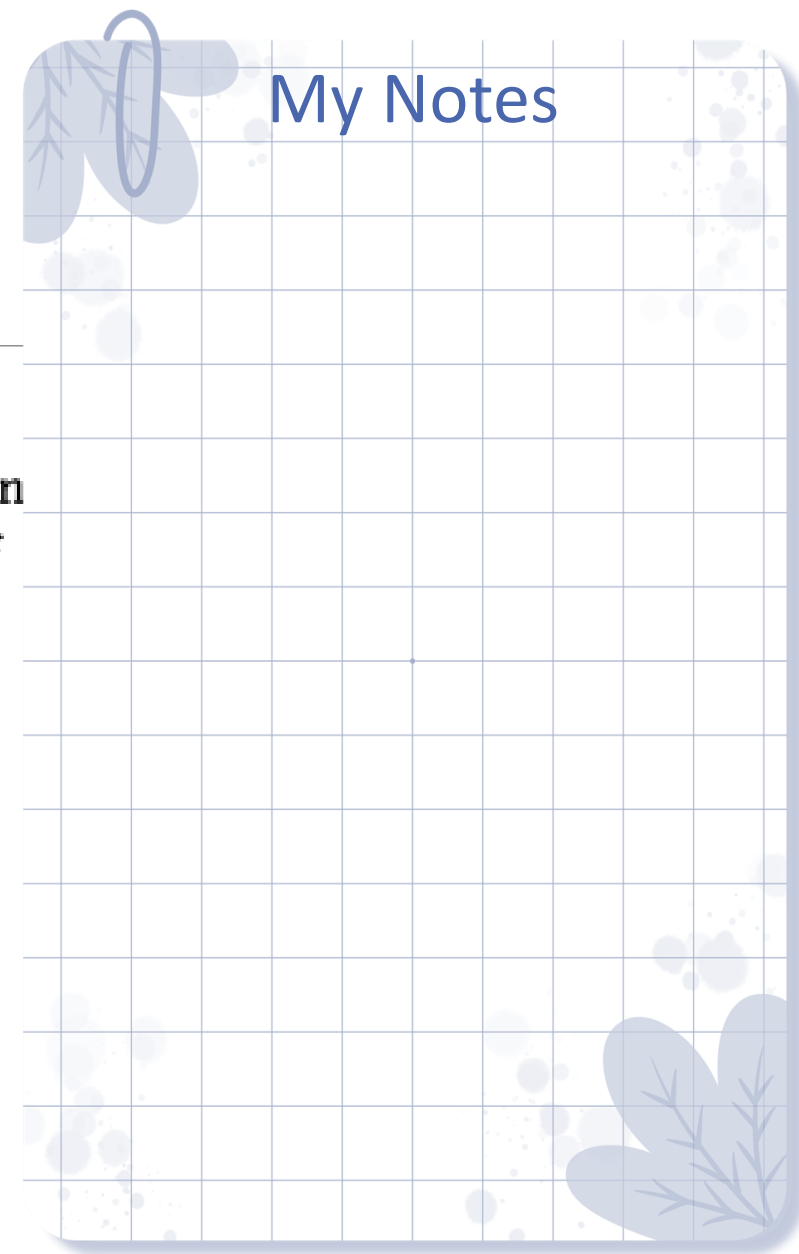
Difference between literature review and summary of the literature

the same theme is identified are referenced in one place where the theme is being discussed as a part of the literature review. Under each theme the main findings relating to it from all the sources you have searched are mentioned and compared, pointing to similarities and differences between them. This is usually followed by a statement of conclusions with respect to the theme. The themes are then put together in a logical progression. A summary of the literature is a summary of the main findings from each relevant reference you searched. In a literature review you describe each theme that emerged during the literature search, citing its origin, comparing it with others and integrating it in a logical manner with the rest.



Difference between literature review and summary of the literature

Summary of literature: A summary of literature is a description of the significant findings of each relevant piece of work that you have gone through as a part of your literature search. The summary basically entails listing, under each pertinent source, the major findings of relevance to your study. The sources searched can be listed in any order.



How to review the literature

If you do not have a specific research problem, you should review the literature in your broad area of interest with the aim of gradually narrowing it down to what you want to find out about. It is like funnelling your ideas. To start with, these ideas are very broad and vague but as you get more insight into your research problem you narrow and refine them to select something that you are really interested in. Once you have reasonably narrowed your research problem, the literature review should then be focused around your research problem. There is a danger in reviewing the literature without having a reasonably specific idea of what you want to study. It can condition your thinking about your study and the methodology you might use, resulting in a less innovative choice of research problem and methodology than otherwise would have been the case. Hence, you should try broadly to conceptualise your research problem before

How to review the literature

undertaking your major literature review. Your literature search should concentrate around the main themes of your research problem and should be undertaken as if you are answering the following questions:

- What is already known in the area?
- What is not known or what are the gaps in the existing body of knowledge?
- What questions have remained unanswered?
- Are there any areas of professional conflict?
- What theories have been put forward relevant to your area of research?
- What suggestions have been made for further research?
- What research strategies have been employed by others undertaking similar research?

How to review the literature

There are four steps involved in conducting a literature review

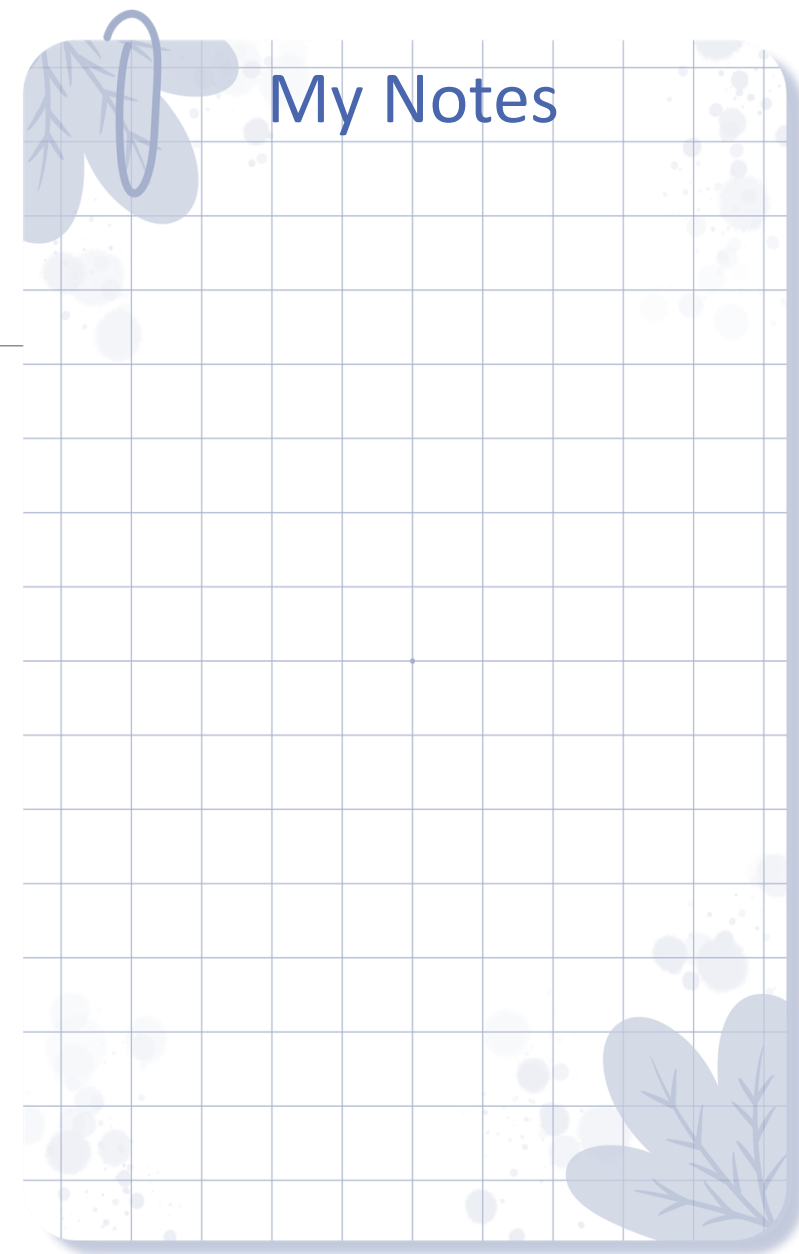
1. Searching for the existing literature in your area of study.
2. Reviewing the selected literature.
3. Developing a theoretical framework.
4. Developing a conceptual framework.

The skills required for these tasks are different. Developing theoretical and conceptual frameworks is more difficult than the other tasks.

Searching for existing literature

To search effectively for the literature in your field of enquiry, it is imperative that you have at least some idea of the broad subject area and of the problem you wish to investigate, in order to set parameters for your search. You must also have some idea of the study population. For example, you should decide whether your interest lies in studying immigrants, youth, women, students, or residents of an institution. You also need to have some idea as to what it is about your population that you want to study. For example, in the case of immigrants, you might want to study their settlement process, reasons for immigration or patterns of occupational mobility. Next, compile a bibliography for this broad subject area. There are four sources that you can use to prepare a bibliography:

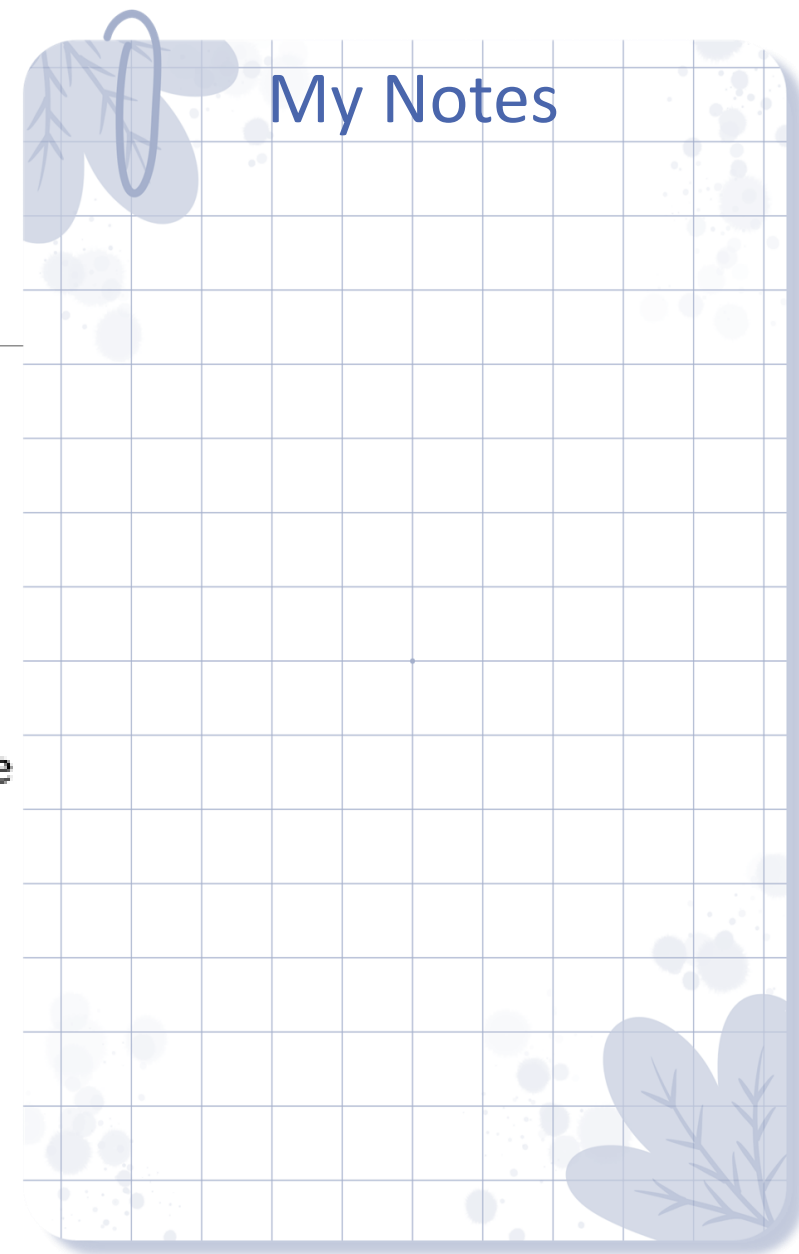
1. books;
2. journals;
3. conference papers;
4. the Internet.



Searching for existing literature

Books

Though books are a central part of any bibliography, they have their disadvantages as well as advantages. The main advantage is that the material published in books is usually important and of good quality, and the findings are 'integrated with other research to form a coherent body of knowledge' (Martin 1985: 33). The main disadvantage is that the material is not completely up to date, as a year or more may pass between the completion of a work and its publication in the form of a book.



Searching for existing literature

Journals

You need to go through the journals relating to your research in a similar manner. Journals provide you with the most up-to-date information, even though there is often a gap of 2–3 years between the completion of a research project and its publication in a journal. You should select as many journals as you possibly can, though the number of journals available depends upon the field of study. There are a number of ways to find the journals you need to examine in order to identify the literature relevant to your study. You can:

- locate hard copies of the journals that are appropriate to your study;
- look at citation or abstract indices to identify and/or read the abstracts of such articles;
- search electronic databases.



Searching for existing literature

Conference papers

Another important source for the literature review is the papers presented at professional conferences. These can provide you with the most recent research in the area. You should try to get copies of the papers presented at recent conferences in your area of interest.



Searching for existing literature

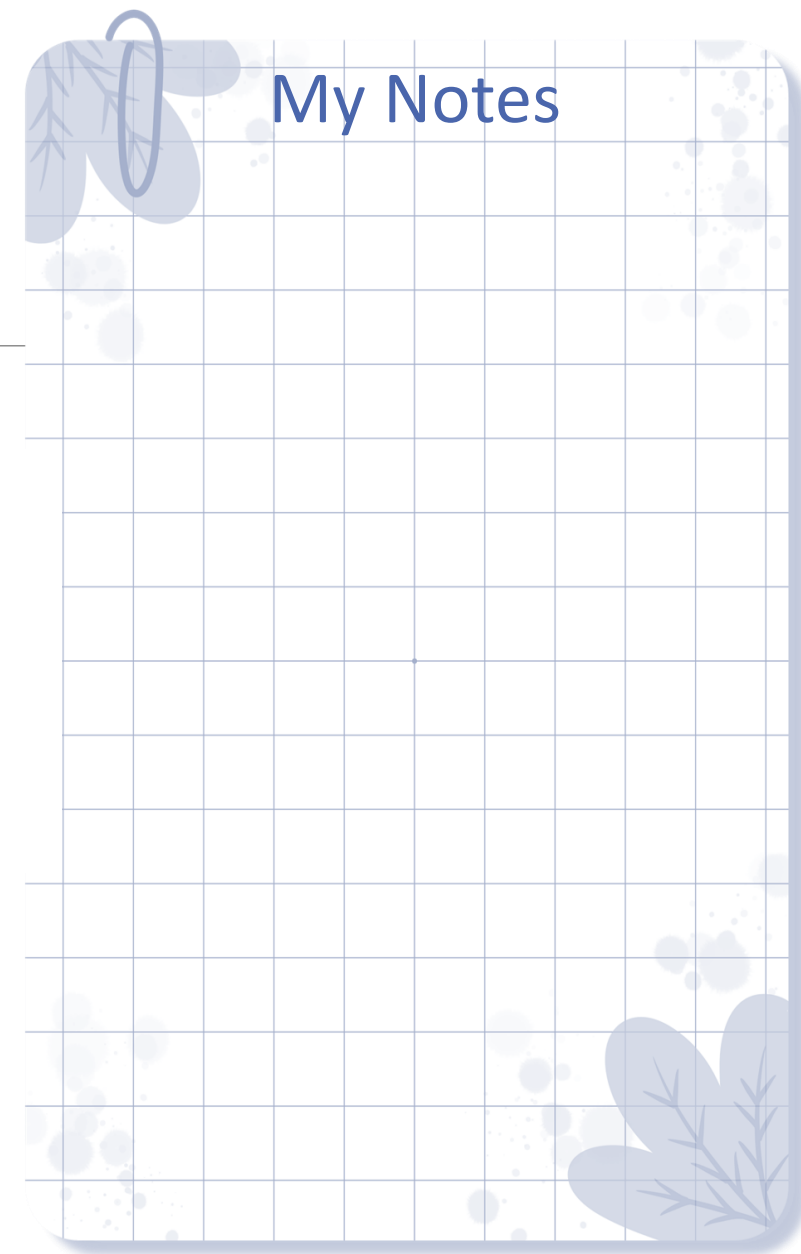
The Internet

In almost every academic discipline and professional field, the Internet has become an important tool for finding published literature. Through an Internet search you can identify published material in books, journals and other sources with immense ease and speed.



Reviewing the selected literature

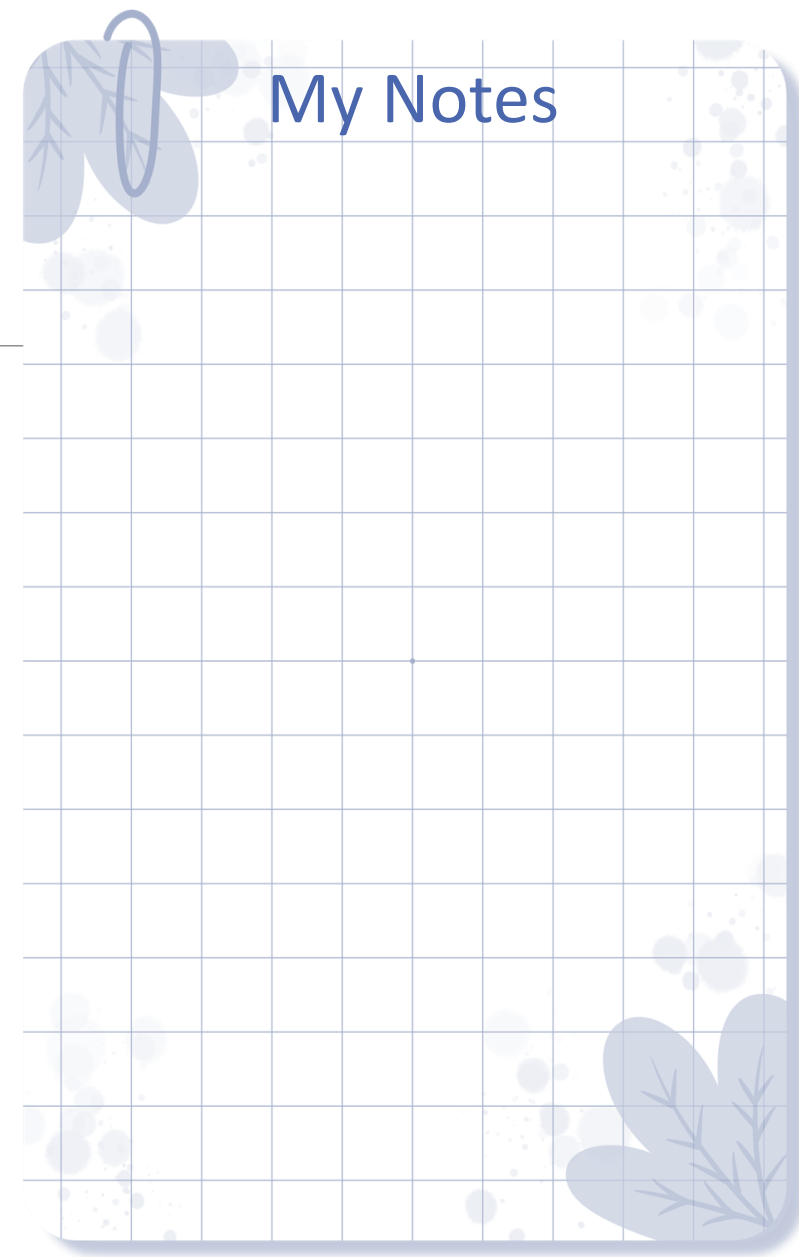
Now that you have identified several books and articles as useful, the next step is to start reading them critically to pull together themes and issues that are of relevance to your study. Unless you have a theoretical framework of themes in mind to start with, use separate sheets of paper for each theme or issue you identify as you go through selected books and articles. The following examples detail the process.



Reviewing the selected literature

The author recently examined, as part of an evaluation study, the extent of 'community responsiveness' in the delivery of health services in Western Australia by health service providers. Before evaluating the extent of its use, pertinent literature relating to 'community responsiveness in health' was identified and reviewed. Through this review, many themes emerged, which became the basis for developing the theoretical framework for the study. Out of all of this, the following themes were selected to construct the theoretical framework for the evaluation study:

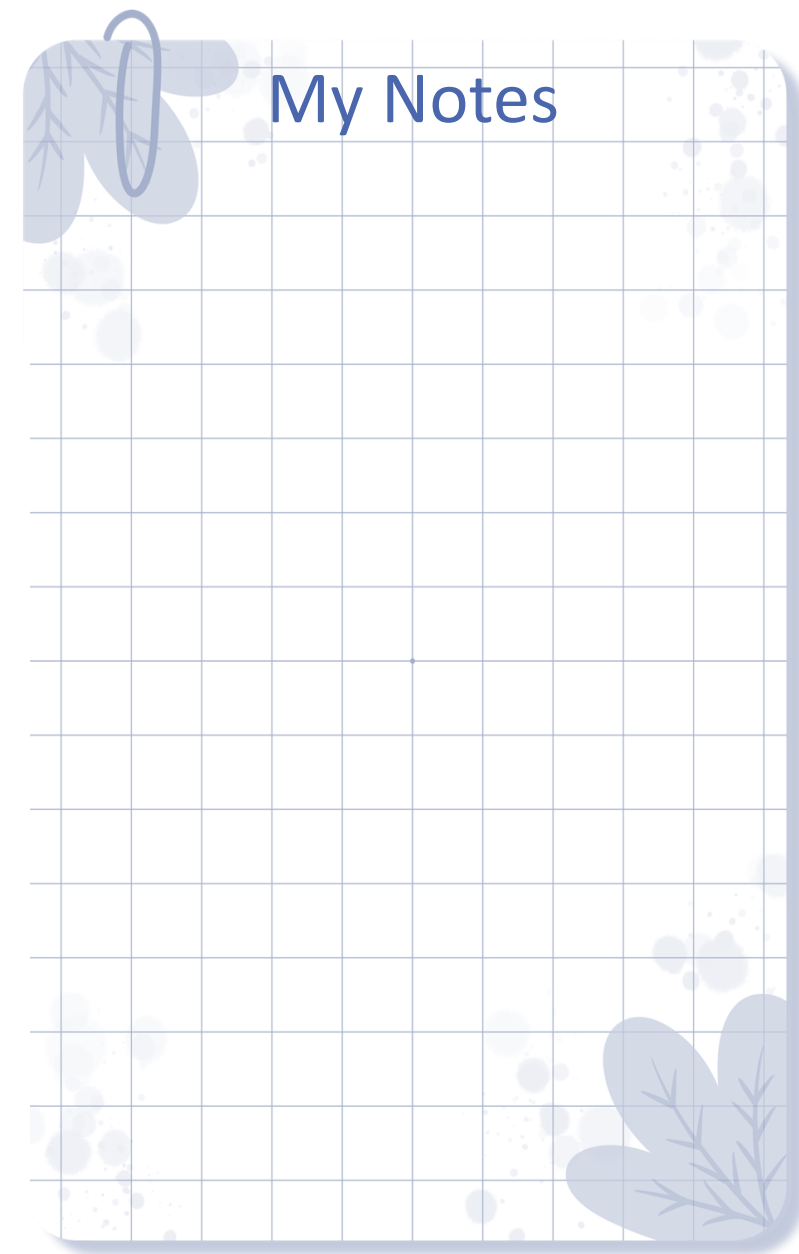
- Community responsiveness: what does it mean?
- Philosophies underpinning community responsiveness
- Historical development of the concept in Australia
- The extent of use in health planning
- Strategies developed to achieve community responsiveness



Reviewing the selected literature

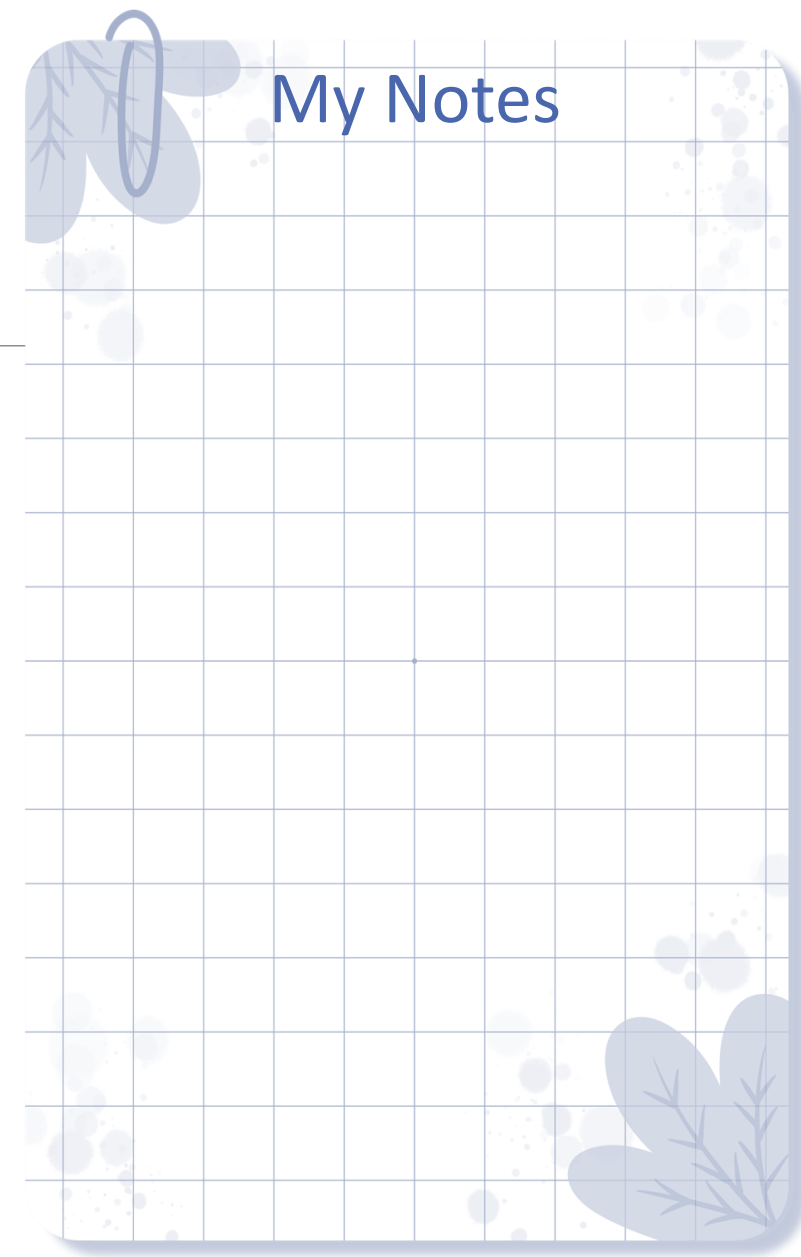
Once you develop a rough framework, slot the findings from the material so far reviewed into these themes, using a separate sheet of paper for each theme of the framework so far developed. As you read further, continue slotting the information where it logically belongs under the themes so far developed. Keep in mind that you may need to add more themes as you go along. While going through the literature you should carefully and critically examine it with respect to the following aspects:

- Note whether the knowledge relevant to your theoretical framework has been confirmed beyond doubt.
- Note the theories put forward, the criticisms of these and their basis, the methodologies adopted (study design, sample size and its characteristics, measurement procedures, etc.) and the criticisms of them.
- Examine to what extent the findings can be generalised to other situations.



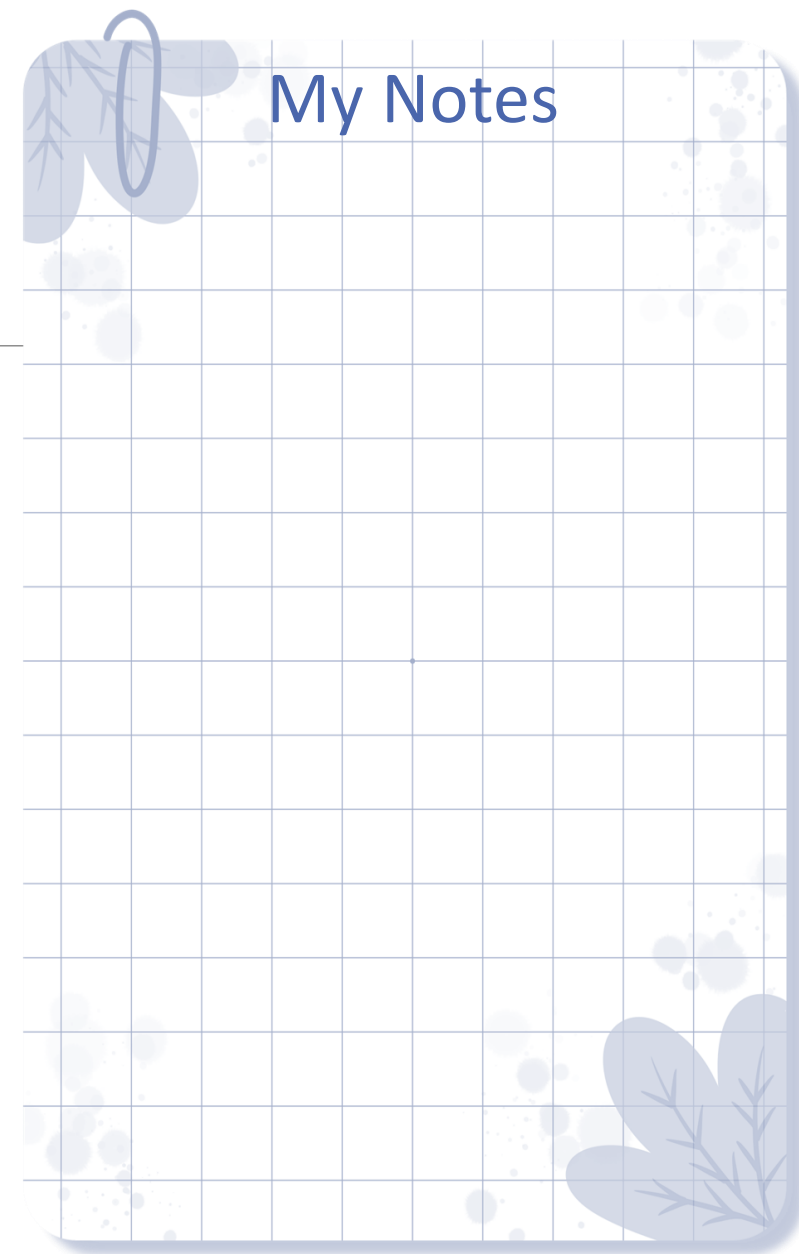
Developing a conceptual framework

The conceptual framework is the basis of your research problem. It stems from the theoretical framework and usually focuses on the section(s) which become the basis of your study. Whereas the theoretical framework consists of the theories or issues in which your study is embedded, the conceptual framework describes the aspects you selected from the theoretical framework to become the basis of your enquiry. For instance, in the example cited in Figure 3.1a, the theoretical framework includes all the theories that have been put forward to explain the relationship between fertility and mortality. However, out of these, you may be planning to test only one, say the fear of non-survival. Similarly, in Figure 3.1b, the conceptual framework is focused only on indicators to measure the success or failure of the strategies to enhance community responsiveness. Hence the conceptual framework grows out of the theoretical framework and relates only and specifically to your research problem. The conceptual framework becomes the foundation of your study.



Writing about the literature reviewed

Now, all that remains to be done is to write about the literature you have reviewed. As mentioned at the beginning of this chapter, two of the broad functions of a literature review are (1) to provide a theoretical background to your study and (2) to enable you to contextualise your findings in relation to the existing body of knowledge, in addition to refining your methodology. The content of your literature review should reflect these two purposes. In order to fulfil the first purpose, you should identify and describe various theories relevant to your field and specify gaps in existing knowledge in the area, recent advances in the area of study, current trends and so on. In order to fulfil the second, you should integrate the results from your study with specific and relevant findings from the existing literature by comparing the two for confirmation or contradiction. Note that at this stage you can only accomplish the first purpose of the literature review, to provide a theoretical background to your study. For the second, the contextualisation of the findings, you have to wait till you are at the research report writing stage.



Sample outline of the literature review

Figure 3.2a Sample outline of a literature review

Intercountry adoption in Western Australia

(A profile of adoptive families)

The literature was reviewed under the following themes:

- Introduction (introductory remarks about adoption)
- History and philosophy of adoption
- Reasons for adoption
- Trends in adoption (global and national)
- Intercountry adoption
- History of intercountry adoption in Western Australia
- Trends in intercountry adoption in Western Australia
- The Adoption Act in Western Australia
- The adoption process in Western Australia
- Problems and issues in adoption
- Gaps in the literature (in this case it was a lack of information about those parents who had adopted children from other countries that became the basis of the study)

Watch this video: What is a literature review?



Watch this video: Critically Evaluating resources



Watch this video: How to Write a Literature Review?



A laptop is shown on a desk, displaying the Adobe Lightroom interface. The screen shows a landscape photo of a field with trees in the background. The interface includes various panels like 'Navigator', 'Library', 'Develop', 'Map', 'Book', 'Slideshow', 'Print', and 'Web'. A quote is overlaid on the screen in large white text. The background of the image is a blurred desk with a lamp, a plant, and some jars.

It doesn't make sense to hire smart people and tell them what to do; we hire smart people so they can tell us what to do.

Steve Jobs

@SalhaAlzahrani