3

STRUCTURING THE RESEARCH PROJECT

Research projects are set up in order to explain a phenomenon or to test a theory. Research methods are the practical techniques used to carry out research. They are the 'tools of the trade' that make it possible to collect information and to analyse it. What information you collect and how you analyse it depend on the nature of the research problem, the central generating point of a research project. Hence the need for total clarity in defining the problem and limiting its scope in order to enable a practical research project with defined outcomes to be devised.

Mostly, research methods courses at undergraduate and more advanced levels culminate, not in an exam, but in a research project or dissertation where you can demonstrate how you have understood the process of research and how various research methods are applied. Hence the need to be clear about the process as a whole so that the methods can be seen within the context of a project.

THE RESEARCH PROCESS

It is necessary to first define some kind of **research problem** in order to provide a reason for doing the research. The problem will generate the subject of the research, its aims and objectives, and will indicate what sort of data need to be collected in order to investigate the issues raised and what kind of analysis is suitable to enable you to come to conclusions that provide answers to the questions raised in the problem.

This process is common to virtually all research projects, whatever their size and complexity. And they can be very different. These

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differences are due to their subject matters; for example, compare an investigation into sub-nuclear particles with a study of different teaching methods, differences in objects of study, scales of time and resources, and extent of pioneering qualities and rigour. Some projects are aimed at testing and refining existing knowledge, others at creating new knowledge.

The answers to four important questions underpin the framework of any research project:

- What are you going to do? The subject of your research.
- Why are you going to do it? The reason for this research being necessary or interesting.
- How are you going to do it? The research methods that you will use to carry out the project.
- When are you going to do it? The programme of the work.

The answers to these questions will provide a framework for the actual doing of the research. The answers to these questions are not simple. This book has been written to give you an indication of what is involved in answering these questions.

Figure 3.1 shows the structure of a typical research project. This shows a rather linear sequence of tasks which is far tidier than what happens in reality. As knowledge and understanding increases during the course of the project, it is subject to constant reiteration. However, a diagram is useful in order to explain the main order of the different stages in the research, and can be used in order to plan out a programme of work in the form of a timetable. The progress of the project can then be gauged by comparing the current stage of work with the steps in the process.

THE RESEARCH PROBLEM

There is no shortage of problems throughout the world, but for a problem to be researchable, it needs to have several crucial features. It must be:

- stated clearly and concisely;
- significant i.e. not trivial or a repeat of previous work;

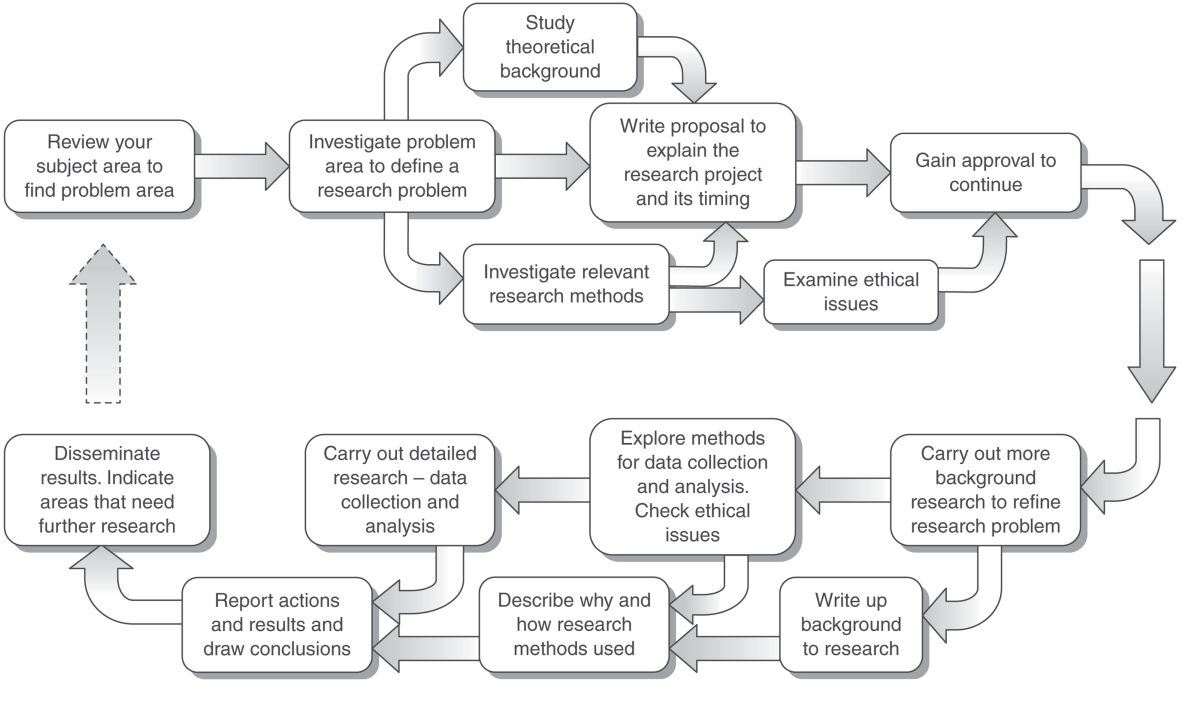

Figure 3.1 Structure of a typical research project

- delineated, in order to limit its scope to practical investigation;
- possible to obtain the information required to explore the problem; and
- possible to draw conclusions related to the problem, as the point of research is to find some answers.

A research problem can be based on a question, an unresolved controversy, a gap in knowledge or an unrequited need within the chosen subject. An awareness of current issues in the subject, an inquisitive and questioning mind and an ability to express yourself clearly are required in order to find and formulate a problem that is suitable for a research project.

Initially, it is useful to define no more than a **problem area** within the general body of knowledge or subject, rather than a specific research problem, e.g. school truancy, energy saving in buildings, homecare for the elderly etc. Then, by examining the different aspects of the problem area, you can hone in on an aspect that is of particular interest to you, is controversial, or is of particular significance. Then a rationale for the research problem can be defined. This can be done, for example, by raising a question, defining some research objectives or formulating a hypothesis.

DEFINING THE RESEARCH PROBLEM

Here are several forms in which the research problem can be expressed to indicate the method of investigation.

Question or questions

Probably the simplest way to set up a research problem is to ask a question. This might be quite abstract in nature, so will require to be broken down into several sub-questions that can be practically investigated. The nice thing about questions is that they demand answers – a good incentive to do some research! Here is an example of a research problem expressed as a main question:

Main question: Are school exam results a true test of a student's intelligence?

Questions can then be used to break the main problem down into questions to define **sub-problems**. The different things you can do to split up the main question are to:

- Split it down into different aspects that can be investigated separately, e.g. political, economic, cultural, technical.
- Explore different personal or group perspectives, e.g. employers, employees.
- Investigate different concepts used, e.g. health, wealth, confidence, sustainability.
- Consider the question at different scales, e.g. the individual, group, organization.
- Compare the outcomes of different aspects from the above ways of splitting down.

In this case the sub-questions could concentrate on:

- What constitutes intelligence? (Investigating a concept, i.e. 'intelligence')
- What ways of testing intelligence are there? (Exploring different perspectives – i.e. other intelligence tests, and thus investigating the concept 'test')
- What sort of school exams are there and how are they marked? (Investigating another concept – i.e. 'exams')
- How do school exam criteria match those of the criteria of other intelligence tests? (Split into aspects – in this case, criteria of exams and other intelligence tests)

Note how all the sub-questions relate directly to the main question and break down the rather abstract question into practical questions that can be investigated individually and build up to an answer to the main question. For smaller-scale studies, an exploratory approach may be used. The subject and scope of the exploration can be expressed in a statement of intent. Again, this must be derived from the research problem, imply a method of approach and indicate the outcome. An example of this form of research definition is as follows:

> This study examines the problem of career development of women engineers in the automotive industry in Britain. It focuses on the identification of specific barriers (established conventions, prejudices, procedures, career paths) and explores the effectiveness of specific initiatives that have been aimed at breaking down these barriers.

Note how the problem, in this case of career development, is narrowly delimited in order to put a boundary around the scope of the work, for example only women engineers, only in the automotive industry, and only in Britain. It also lists the practical tasks to be carried out, i.e. identification of specific barriers, and exploration of initiatives. This list of barriers stipulates in more detail the actual subjects of the investigation.

Hypotheses

The research problem in research projects that use the hypothetico-deductive method is expressed in terms of the testing of a particular hypothesis.

Hypotheses are nothing unusual; we make them all the time. If something happens in our everyday life, we tend to suggest a reason for its occurrence by making rational guesses. These reasonable guesses can be expressed in the form of a **statement**. This is a hypothesis. If, on further examination, a particular hypothesis is found to be supported, i.e. the reasons for its occurrence seem to be correct, we have got a good chance that we can predict what will happen in the same situation in the future, or can devise actions to prevent it happening again. If the investigation shows that the guess was wrong, then it can be rejected as false. Many of the greatest discoveries in science were based on hypotheses: Newton's theory of gravity, Einstein's general theory of relativity and a host of others.

A good hypothesis is a very useful aid to organizing the research effort, but it must have certain qualities. It must be a statement that can be put to the test. It must specifically limit the enquiry to the interaction of certain factors (usually called variables) and suggest the methods appropriate for collecting, analysing and interpreting

the data, and the resultant confirmation or rejection of the hypothesis through empirical or experimental testing must give a clear indication of the extent of knowledge gained.

So, to express the above example of a **research question** in the form of a hypothesis, it would need to be written simply like this as a statement:

> School exam results are a true test of a student's intelligence – Main hypothesis.

The formulation of the hypothesis is usually made on an abstract or conceptual level in order to enable the results of the research to be generalized beyond the specific conditions of the particular study. However, one of the fundamental criteria of a hypothesis that it is testable but formulated on a conceptual level cannot be directly tested; it is too abstract. It is therefore necessary to convert it to an operational level. This is called **operationalization**.

Often, the first step is to break down the main hypothesis into two or more sub-hypotheses. These represent components or aspects of the main hypothesis and together should add up to its totality. Each sub-hypothesis will intimate a different method of testing and therefore implies different research methods that might be appropriate. This is a similar process to breaking down main research questions into sub-questions. For example:

> The intelligence of students can be measured – First sub-hypothesis.
> Specially devised tests have been devised to accurately measure levels of intelligence – Second sub-hypothesis.
> School exams contain suitable tests to measure students' intelligence – Third sub-hypothesis.
> The accuracy of school exams to test intelligence is commensurate with specially devised intelligence tests – Fourth sub-hypothesis.

The operationalization of the sub-hypotheses follows four steps in the progression from the most abstract to the most concrete expressions by defining concepts, **indicators**, **variables** and **values**. These are described in more detail in Chapter 6.

Propositions

Focusing a research study on a set of **propositions**, rather than on a hypothesis, allows the study to concentrate on particular relationships between events, without having to comply with the rigorous characteristics required of hypotheses. The first proposition is a statement of a particular situation, which is then followed with further propositions that point out factors or events that are related to it and ending with one that indicates a conclusion that could be drawn from these interrelationships. An example will help explain this.

The main research problem was formulated in the form of three interrelated propositions:

- Specifically designed public sector housing provided for disabled people continues to be designed according to the government recommendations and standards for disabled people's housing.
- The recommendations and standards are not based on an accurate perception of the needs of disabled people.
- Therefore there is a mismatch between the specifically designed public sector housing provided for disabled people and their accommodation requirements.

In this example it is clear that the research must investigate what the actual accommodation requirements of disabled people are, what the government perception of their needs is, and how they compare.

THE USE OF ARGUMENT

The whole point of doing a research project is to identify a particular question or problem, to collect information and to present some answers or solutions. In order to convince the reader that you have collected information relevant to the question or problem and that you have based your answers and conclusions on the correct analysis of this information you will need to use some logical **argument**.

You might want to defend or challenge a particular point of view or propose a new or improved one. You will have to play the part of a detective making a case in court. The detective will set out to solve the problem (who committed the crime and how?) by analysing the situation (the scene and events of the crime, the possible suspects),

collecting and reviewing the evidence, then making a case for his/her conclusions about 'who-done-it' and how. The jury will have to decide whether the argument is convincing and that the evidence is sufficiently strong. In the case of a research project, you will be setting the problem and laying out your case, and the reader of your report, dissertation or thesis will be your jury.

As mentioned in the previous chapter, there are two basic stages to an argument: the **premises**, which are statements in the form of propositions or assertions which form the basis of the argument (this can be seen as the evidence), and the **conclusion**, which is a proposition that expresses the inference drawn by logical steps from the original premises.

Arguments are based on logical reasoning, of which, as explained in the previous chapter, there are two basic types: inductive reasoning, which entails moving from particular repeated observations to a general conclusion, and deductive reasoning, which entails going from a general principle (called a premise) to a conclusion about a particular case. The hypothetico-deductive method or scientific method is a further development of logical reasoning based on the principle that we can never be completely sure of any premises or conclusions that we make, but we can be more confident about some than others. The more a premise or a conclusion has been tested and supported by repeated investigations, the more likely it is to be true. Also, conclusions can be refined if they are only seen to be true in particular situations. All scientific facts, such as the theory of gravity, are based on this approach.

It is important to be aware of the type of reasoning that you will use to make your argument, or if you are reading through the research literature, what type of reasoning is used by each of the writers. Of course, it is not always easy to detect the simple steps of the argument as described above, so it is worth knowing what to look out for when doing your background reading. There are also pitfalls that can occur to weaken or even invalidate the value of an argument, however persuasive it might seem at first reading.

Recognizing and testing arguments

As well as constructing arguments to support your research conclusions, it is also necessary to recognize and scrutinize other people's

arguments, particularly those on whose work you are basing your research.

Recognizing arguments

In many types of writing and other forms of **discourse**, e.g. conversation, TV programmes, speeches, etc., the argument may be poorly expressed or submerged within the content. In order to recognize when an argument is being made, look for words that indicate a premise such as:

- since
- because
- if
- assuming that
- given that, etc.

Then look for words that indicate that a conclusion follows, such as:

- therefore
- this proves that
- then
- consequently
- thus, etc.

Then look for any logical reasoning and evidence that is given to link the two.

Testing deductive arguments

There are techniques that can be used to distinguish between sound and valid deductive arguments and fallacious ones, i.e. those whose logic follows the correct rules and those that do not.

So what are the correct rules? A technical definition goes as follows: An argument is both sound and valid if all its logical steps inevitably lead from true premises to a true conclusion. A valid argument that begins with false premises is not sound. Here are a couple of simple examples to demonstrate this.

The following is both a sound and a valid argument, assuming that the first line (the premise) is true:

> Mary owns either a Honda or a Ford
> Mary does not own a Ford
> Therefore, Mary owns a Honda

This one is valid but the premise is not true, so is therefore not a sound argument:

> Mary owns either the Moon or Saturn
> Mary does not own Saturn
> Therefore, Mary owns the Moon

Obviously, real arguments pursued in research are not as simple as these are, but the rules are the same. There will inevitably be many premises, some of whose truth might be open to debate, and the logical steps will probably be more numerous and complicated. However, you should strive to convince the reader about the truth of your premises (which will be a combination of your theoretical stance and the evidence gleaned from your data) and to enable the reader to track through the steps in your argument to your conclusions.

Fallacies fall into two main categories: formal and informal.

Formal fallacies are those where the logical structure underpinning the argument is faulty in some way. There are many ways that logical structures can be faulty, too many to consider here, but for one example, consider the following simple argument:

> No lawyers are criminals.
>
> John is not a lawyer.
>
> Therefore, John is a criminal.

This makes a hidden assumption that all people who are not lawyers are criminals. This is not one of the premises. If a first line was added that went 'All non-lawyers are criminals' then the logic of the argument and its conclusion would be sound, despite the preposterous premises. Just like with computer programs: rubbish in – rubbish out!

Here are a couple more to consider:

If I run too much, I'll be tired.
Since I have not run too much,
I will not be tired.

All artists are really sensitive people.
However, some really sensitive people are not properly appreciated.
So, some artists are not properly appreciated.

The faulty logic in the first example ignores the fact that the same result can be produced by different causes. In the second, it does not cover everybody who is really sensitive and not appreciated, i.e. some artists could be an exception – it would have been ok if it stated '**all** really sensitive people'.

Informal fallacies also come in many guises. These are misleading not so much because the logical steps are incorrect, but because they make false analogies, use emotional and misleading claims, and jump to unjustified conclusions on evidence that is skimpy, irrelevant or untrue. The following example makes false analogies:

The ship of government, like any ship, works best when there is a strong captain in charge of it. That is why government by dictatorship is more effective.

Is a ship really sufficiently like a government to make this claim? And how about these two:

I don't think we should employ Mr Jones.
I am told he is a poor tennis player.
Careless people are bad at tennis,
So I don't think it is a good omen.

Look, you are a lawyer.
Your employer decided to increase your work load because they knew it would be good for its lawyers.
It must therefore be good for you.

In the first, note that there are other people who are bad at tennis, not only careless ones. So it does not follow that Mr Jones is

necessarily careless. In the second, the sweeping generalization made by the employer might not suit every lawyer.

If you want to see more examples of types of fallacies, and even learn their names, you can look up any book on logic or follow the link given in the 'Where to find out more' section of this chapter.

Constructing an argument

Although Bonnett (2011) provides a choice of six types of argument, I reckon that there are only two basic aims of argumentation. One is to argue for a statement by providing evidence that will support it. The other is to refute a statement by providing evidence that undermines it. Between these opposites can be a combination of the two, which entails a less black and white approach by arguing for a revision or refinement of the statement to get nearer to the truth, again based on the evidence presented. Another combination compares two statements, usually stating the opposite, and argues that one is right and the other is wrong.

To argue in support of a concluding statement, you need to demonstrate that the premises are true. This may not be straightforward as truth is often difficult to pin down. Evidence in the form of data confirmation or agreement among experts will help to substantiate the strength of your claim. In research, evidence will often be new data generated by the project, so the reliability of sources and the methods of data collection must be clearly explained and justified. You then must employ a sound logical progression of steps to bring you to the conclusions. The conclusions must be based exclusively on the premises. If it is not possible to be absolutely certain that the conclusions are inevitable, you have the option to soften the concluding statement with conditions such as 'it is likely that', 'it is probable that', etc.

To refute a concluding statement requires you to show that the conclusion is false or untrue. This can be done by challenging the logic of the argument, challenging the truth of evidence on which the argument is based, or questioning the relevance or completeness of the evidence. Another way to challenge an argument is to produce counter-examples that are deployed against either the premises or/and conclusions. This will undermine the universality of the argument, i.e. demonstrating that it does not hold in all cases. Alternatively, you might be able to demonstrate that the conclusions drawn will lead to absurdity if taken far enough.

Constructing an argument and coming to conclusions about a research project is a cumulative process. It is unlikely that the chosen problem is simple, with questions raised that can be answered with a simple yes or no. Even if they can, you will be required to describe why it is one or the other and make an argument to support your case. Normally, the problem is divided down into smaller components requiring separate investigations. Conclusions about these components will occur in various sections of the analysis part of the report or dissertation. Skill is then required to gather these up at the end in the concluding section to fit them together into a 'mosaic' that will present the complete picture of the conclusion to the main problem.

WHERE TO FIND OUT MORE

You can quickly get into deep water on the subject of thinking and argument. I would recommend Brink-Budgen or Bonnett to start with, and perhaps follow up the references in there if you want to find out more on specific issues. The others I have listed require you to have either a special interest or that you have chosen a topic that focuses on aspects of these subjects.

Brink-Budgen, R. (2010) *Critical Thinking for Students: Learn the Skills of Critical Assessment and Effective Argument* (fourth edition). Oxford: How To Books.
This has an associated website for exchange of ideas, experiences, etc.

Bonnett, A. (2011) *How to Argue* (third edition). Harlow: Pearson Education.

Cottrel, S. (2017) C*ritical Thinking Skills: Developing Effective Analysis and Argument (Palgrave Study Skills)* (third edition). Basingstoke: Palgrave Macmillan.
If you really want to get into more depth about logic and argument these are reasonably approachable books, listed in order of easiest first:

Hodges, W. (2001) *Logic: An Introduction to Elementary Logic* (second edition). London: Penguin.

Salmon, M. H. (2013) *Introduction to Logic and Critical Thinking* (sixth edition). Belmont, CA: Wadsworth.

Gensler, H. J. (1989) *Logic: Analyzing and Appraising Arguments*. London: Prentice-Hall International.

Fisher, A. (2004) *The Logic of Real Arguments* (second edition). Cambridge: Cambridge University Press.
These are two amusing books about fallacy that might interest you:

Pirie, M. (2020) *How to Win Every Argument: The Use and Abuse of Logic* (second edition). London: The Continuum.
Well-written and entertaining.

Thouless, R. H. and Thouless, C. R. (2011) *Straight and Crooked Thinking* (fifth edition). London: Hodder Education Books.
A classic book first published in 1930, but still entertaining and thought-provoking.

USEFUL WEBSITES

For a more comprehensive explanation of fallacies, look here:
https://examples.yourdictionary.com/examples-of-logical-fallacy.html
or:
https://iep.utm.edu/xy/ (almost 200 informal fallacies explained!)
For good advice on the use of rhetoric in argument, and how to use it to engage the reader, see this chapter:
https://courses.lumenlearning.com/englishcomp21xmaster/chapter/research-writing-and-argument/