Part I

GETTING STARTED

Research sounds serious, very serious. But it can also be fun. It all depends on whether you know what you’re doing or not!

As with any journey, you have to start somewhere. In this part we consider the first steps in getting informed, the first steps in a researcher’s academic career, and the first steps in a research project.

In Chapter 1 we first describe various types of research. In Chapter 2 we present a ‘research recipe’ giving the basic steps in the research process. We discuss the first two steps: finding a topic and preparing a statement of the research problem. In Chapter 3 we describe sources of information and how to access them. This includes exploiting the library and the information superhighway, the Internet. Finally in Chapter 4 we outline the processes of enrolling for postgraduate study and of obtaining funding.

Have fun!
1 Types of Research

While research often draws from several types, there are several common types of research. In this chapter we discuss the types of research and when they are appropriate.

1.1 EXPERIMENTAL RESEARCH

The cornerstones of science are experimental and creative research. In experimental research, one is primarily interested in cause and effect. Researchers identify the variables of interest, and seek to determine if changes in one variable (called the independent variable, or cause) result in changes in another (called the dependent variable, or effect). Experimental research might be used to determine if a certain chemical is fire resistant or if a new teaching method achieves better results.

Some variables might be present which are neither the independent nor the dependent variable, but still need to be considered. Say we wanted to test whether a new drug was effective in reducing blood pressure in rats. The independent variable would be the use or non-use of the new drug, the dependent variable the blood pressure. However, other factors may have an effect on blood pressure: for example, the rat’s genetic make-up, its weight, and its stress level. To get a true answer to the question of the relationship between the independent and the dependent variable, the effect of these other factors must somehow be ‘cancelled out’. One common way to do this is to use two groups, an experimental group and a control group, which are treated identically except for the use or non-use of the drug. The design of such experiments is discussed in Chapter 5.

1.2 CREATIVE RESEARCH

Creative research involves the development of new theories, new procedures and new inventions. For example, a computer scientist might apply new algorithms for managing a computer system, an economist might develop a new model of the world economic system, or an electronic engineer might design a new radio. Creative research is used to some extent in all fields. Unlike experimental research, creative research is much less structured and cannot always be preplanned.

Creative research includes both practical and theoretical research. Practical creative research is about the design of physical things (artefacts) and development of real-world
processes. Theoretical creative research is about discovery or creation of new models, theorems, algorithms, etc. Practical research mainly proceeds by trial and error.

1.3 DESCRIPTIVE RESEARCH

Descriptive, or ‘case-study’, research is where a specific situation is studied either to see if it give rise to any general theories, or to see if existing general theories are borne out by the specific situation. An example of this is Mead’s anthropological studies of isolated cultures to see whether pervasive social organisations are essential features of humankind (Lou91).

Descriptive research may be used when the object of the research is very complex. For example, in trying to study the effectiveness of health-care delivery systems, a researcher might undertake an in-depth case study of a selected few hospitals in a selected few countries, and then compare them to see if any general trends emerge.

1.4 EX POST FACTO RESEARCH

While in experimental research we expose similar groups to different treatments to see the effects of the treatments (moving from cause to effect), in ex post facto we look back at the effects, and try from there to deduce the causes. Ex post facto means ‘from after the fact’, and typically occurs when data is available which could not be generated by experimental research. It is important to note that for ex post facto research to be valid, one must eliminate all other possible causes.

The relationship between road development in an area and its current population would be an example. The latter could of course be experimentally tested, but few researchers have the funds to build road systems or the time to see the effects of this over twenty years!

1.5 ACTION RESEARCH

Kurt Lewin said ‘There’s nothing so practical as a good theory’ (Bar94). This idea is one of the keys to his research approach which has become known as ‘action research’. As an example, if a company had a problem with absenteeism, then the steps in action research would be:

1. The expert gathers comprehensive data about both the specific problem (from the company) and the general topic (from a literature study).
2. The expert and the stakeholders agree on some recommendations and these are implemented by the company.

3. After a suitable time-period, pre-agreed measurements are made to determine the effectiveness of the changes.

(Adapted from App 91)

Some view action research as a philosophy to research rather than a method of research. They reject the attempted separation of the investigator and the problem, and embrace research with a specific goal of social change, and where the research is participatory and emancipatory. An example might be a community deciding on the siting of new facilities.

1.6 HISTORICAL RESEARCH

Studies of the past to find cause-effect patterns are known as historical research. It is often geared towards using past events to examine the current situation and to predict future situations (e.g. stock-market forecasting). The research does not directly study current causes or effects. Data is gathered from primary sources (records made at the time of the past events) and secondary sources (records made after the events).

1.7 EXPOSITORY RESEARCH

This is research based purely on existing information, and normally results in ‘review’-type reports. By reading widely on a field, and then comparing, contrasting, analysing and synthesising all points of view, important new insights can often be made. For example, an analysis of the works of a prominent author, or a comparison of the tax structures in developed and developing countries.

Discussion questions and exercises

1. What type of research might be suitable for each of the following?
   
   (a) design of a new information systems package for doctors
   
   (b) availability of facilities for physically challenged people at sports events
   
   (c) development of a vaccine against HIV/AIDS
   
   (d) the paintings of the early San people
(e) evaluation of a new computer-based teaching technique

(f) factors leading to women having fewer children

(g) the origins of the universe

2. The term ‘empirical research’ is used to describe the study of things as they currently exist in the real world. Ex post facto research is a class of empirical research, while historical research is not. Why should this be the case?
2 Getting Started

This chapter outlines the steps in the research process, and describes in detail the initial phases of choosing a problem topic and formulating a clear research question.

2.1 A ‘RESEARCH RECIPE’

The research process involves the following steps:

(1) Become aware of a topic and problem.
(2) Convert the problem into a well-demarcated research problem.
(3) Carry out the research (data collection or experimentation).
(4) Analyse the results.
(5) Write up the findings.

Steps (1) and (2) are discussed in this chapter, whilst steps (3) to (5) are discussed in detail later in this book.

2.2 BECOMING AWARE OF A PROBLEM

The specific subject addressed by the research is called the topic while the specific question addressed is called the problem. ‘Finding a topic’ is often the first step in research, but sometimes a researcher is presented with a problem which defines the topic to be studied. For postgraduate students, finding a topic and problem can seem the most important thing in their lives.

There are several sources of research problems. The most common sources are:

2.2.1 Prior research

Studies of previous research will often suggest useful new research problems. In scientific study, the answer to a particular problem often suggests a number of new problems—‘the outcome of any serious research can only be to make two questions grow where only one grew before’ (Veblen, see Coh80). For example, Mendel’s early studies into heredity in plants—a translation of his original paper is given in Pet59—raised the
problem of how hereditary traits are passed through generations. This generated a tremendous amount of research in the field of genetics. The understanding of how genes work is now the basis of new research into how genetic material can be altered to produce desirable results (cows which produce more milk, crops which give greater yield). And so on.

2.2.2 Needs

Applied research often arises from specific needs of industries, institutions and even countries. There are many needs—South Africa wants to find materials and designs for quality low-cost housing, a drug company wants to produce a better headache suppressant, a paint company wants to produce longer-lasting paints, a moving firm wants to minimise total distance travelled, a technikon wants to devise an exam timetable which minimises clashes.

2.2.3 New opportunities

New practical and theoretical breakthroughs often open the door to new research on how these breakthroughs can be used. The manufacture of strong, lightweight alloys stimulated research in the field of aircraft design, just as the silicon chip stimulated research in the design and manufacture of more effective computers. The availability of optical technology is even now creating new possibilities in computers. Similarly, Gottfried von Leibniz’s and Isaac Newton’s development of the theory of calculus enabled researchers to solve many problems that were previously unsolvable.

2.2.4 Intellectual curiosity

Some of the greatest research has resulted from someone simply sitting down and asking ‘Why?’ or ‘How?’. Leonardo da Vinci asked how birds fly and produced the first design for a flying-machine. Ignaz Semmelweis in the 1850s asked why more people die in some hospitals than in others and discovered that sterile conditions are necessary in operations (Gro95). Of course, the impulse to ask ‘Why?’ is fundamentally human—ask any four-year old! But it takes some insight, and some experience, to ask the right question.

All questions were not created equal. Great scientists choose ‘good’ research questions that are answerable by the methods available and provide useful answers. Recognising a ‘good’ question is largely an intuitive step based on experience and mind-set.
A simple example: Isaac Newton is reported to have begun his investigations into gravity after an apple fell on his head. His past experience (background in mathematics) together with the experience of the event (being clobbered by an apple) combined with his mind-set (researcher interested in basic questions of the physical universe) all contributed to his choice of research question. Usually, of course, a far more complex set of experiences is involved when a researcher intuitively decides that a particular topic is ‘promising’ or ‘unpromising’.

It should be stressed that the above—prior research, needs, new opportunities and intellectual curiosity—are major ways in which researchers can gain ideas for topics of research. In order to decide what a good topic in the field would be, the researcher must first have a substantial knowledge of the field in question, and of current developments in the field (normally obtained by a literature study, as discussed in the next chapter).

2.3 PROBLEMS VERSUS RESEARCH PROBLEMS

Say an electronic engineer wants to find the best way to send TV signals to a remote rural community. This is certainly a problem topic, however the problem is not yet clearly defined. What options are there—satellite, microwave relays, land lines, others? Where precisely is the community, and what factors, if any, must be considered? (Landline service to a community in mountainous terrain would be problematic.) What has been done locally and internationally in handling similar problems? These questions and others must be answered in order to convert the engineer’s problem into a scientific research problem.

A research problem should be well understood. This requires a preliminary literature survey and the identification of relevant variables (in the above example, the type of communication medium would be a relevant variable). A full demarcation of the research problem is also necessary—demarcation meaning ‘setting boundaries’. If you don’t know the boundaries of what you’re working on, it is very easy to have no direction to your research—if you don’t know exactly why you are doing something, and exactly what you are doing, it is impossible to know how to do it!

2.4 WHAT SHOULD BE DEMARCATED?

The process of demarcation involves determining the scope of the study, what variables are involved, how the research will be pursued, and what practical constraints are involved.
2.4.1 Scope of study

Do you wish to investigate a general solution, or are you just interested in one that works for a particular area or field? A particular solution to our electronic engineer’s problem might work for the community concerned, but might not be applicable to all remote communities. If a general solution is required, then a far wider study is needed. Similarly, a chemist creating a long-lasting paint needs to know whether the paint is required for houses in the Sahara or for cars in Alaska.

The scope of the full literature study must also be demarcated at this stage—how widely and deeply will you need to study the topic before tackling the problem? The information explosion of recent years has made it impractical to read everything published in a particular field, but a preliminary literature study should give you a reasonable idea of what readings are essential. Chapter 3 gives detail on available sources of information.

2.4.2 Variables

A variable is any item of interest which can have more than one possible value (and so its value can be varied). Variables are at the heart of scientific and engineering research. At this stage of the research the variables involved must be identified.

Some examples of variables:

If one increases the temperature (variable A) what effect does this have on the guinea-pig’s respiration rate (variable B)?

At what signal-to-noise ratio (variable A) is real-time voice communication practical (variable B here is the practicalness or not of the communication)?

How long (variable A) will 2 ml of sulphuric acid take to make a hole through cardboard of various widths (variable B)?

Variables can be either qualitative (vary between settings like practical/non-practical, absent/present or good/mediocre/bad) or quantitative (vary between numerical settings). The quantitative variables can be either discrete (limited to a finite number of possible settings) or continuous (a range of real numbers).

Chapter 5 of this book, which deals with experimental design, discusses variables in more depth.
2.4.3 Research methods

Next you need to specify how you will go about finding a solution or solutions, and what steps are necessary. Part 2 of this book covers various research methodologies in detail.

2.4.4 Practical constraints

The expected cost and duration of the research are important considerations. It is essential that a researcher knows roughly how long the research problem will take to solve, and what it will cost. There are problems which need twenty years of work, others which can be solved in months. Would you have been happy studying for your Bachelor’s degree if nobody could tell you how long it normally took for people to complete? Having an idea of costs is also important, for no research will be practicable unless the necessary funding is available.

2.5 STATEMENT OF THE RESEARCH PROBLEM

Having performed your preliminary study and demarcated the problem, you are now in a position to make a statement of the research problem (often referred to as the ‘statement of the problem’). This statement will be the base on which your eventual report stands, and needs to be clear and coherent. In particular the statement of the research problem will:

- Ask a question(s), normally concerning relationships between variables;
- Be empirically (real-world) testable, and moreover be testable within the time, budget, experience and resource constraints of the researcher; and
- Allow the possibility of the result(s) of the research being useful.

(Adapted from Bester and Olivier (Bes92).)

Finally, the researcher should be interested in solving the problem—nothing is more sure to fail than a researcher who doesn’t really care about the topic she is researching.

Discussion questions and exercises

1. Dover Dairies wants to introduce a new ice-cream product and wants to know what colour the product should be to make it sell. How would you go about converting this into the statement of a research problem?
2. Discuss the difference between a problem and a research problem, and give several examples of both.

3. The city council has money to build one new train line and wants to know where it should go. What factors need to be considered? How would you set about posing this as a research problem?

4. Consider your favourite hobby and propose a research project for it.

5. Obtain a copy of a scientific magazine (such as Omni or Scientific American), read one of the articles and suggest further research questions.
3 Sources of Information

In this chapter we begin by showing why the study of existing information on a field is a vital part of research. We then discuss various sources of information available to the researcher and describe ways in which such information can be accessed. The final section emphasises the importance of notekeeping.

3.1 WHY STUDY THE PAST?

The tragic story of I.M. Abuvit

I.M. Abuvit was a postgraduate student of exceptional intelligence and diligence who had never failed in any task he attempted. On receiving a research topic from a friend in industry, he boldly stated: ‘There is no way I’m spending months looking through boring books and journals. It’s a waste of the time which should be used in solving the problem’. So I.M. set about solving the problem. After a couple of false starts, where he tried approaches which didn’t lead to solutions (it took four months before he discovered that they weren’t going to work), he finally found a promising line of investigation. A year later he proudly presented his finished thesis, expecting accolades for completing his research in just 16 months.

But I.M. Abuvit failed miserably. The examiners noted the following flaws:

(1) Both initial approaches explored by I.M. had been studied before, and there were available publications proving that the approaches would not work. I.M. had wasted four months finding out something he could have discovered in four minutes.

(2) I.M.’s lack of reading had left him ignorant of some of the subtler variables involved in the problem, and he had therefore not included these in his calculations. His final results were thus incorrect.

(3) A journal had reported a successful solution to the specific problem I.M. was working on six months before I.M. began his research. All his research had therefore been unnecessary.

Unfortunately, I.M. Abuvit’s story is rather common. It is vital to find out what other people have discovered about the field in general and about the topic in particular before you leap headfirst into your own research. How solutions to related problems
in the field were found can be enormously helpful in guiding research into the new problem, just as awareness of partial solutions to the new problem can save a lot of legwork. Even a so-called ‘negative result’, where people find that a particular approach will not work, can help you avoid blind alleys.

The term ‘literature study’ is often used to describe the process of finding out about previous work from a range of sources (only some of which are literary). Any good research includes two distinct literature studies:

- A preliminary literature study allows the researcher to get a feel for the topic and issues involved, and understand how the proposed research would fit into it. This is done as preparation for research and should precede any written proposal to conduct research (e.g. proposal of a Masters topic). One important outcome of the preliminary study is finding out what further sources need to be consulted in the full study.

- A full literature study is a far more comprehensive study; this is part of the research process itself rather than part of the preparation for research. The bulk of this study should be done prior to embarking on experimentation or data collection, so that the results of the study may be used. However, during the course of the research itself, you should ‘top up’ your knowledge of recent developments by reading current publications.

### 3.2 SOURCES OF INFORMATION

The main sources of information available to researchers are:

1. Textbooks
2. Scientific journals
3. Conference proceedings
4. Theses and dissertations
5. Company reports
6. People
7. Magazines and newspapers
8. The Internet

The first four items on the list are the most reliable sources of information, and are the most commonly referenced in scientific reporting. We now discuss particular features of each medium.
3.2.1 Textbooks

Textbooks should be the starting place for finding out about a new field. The breadth and depth of detail that can be covered in a full book is far more than the detail that can be covered in a 10 page journal article or conference paper. Textbooks do have an inherent disadvantage though in that they often contain out-of-date information, particularly in fast-growing fields. For most textbooks it takes at the very least a year from the time the first words are written to the time the finished product is available in published form; so a text published in 1999 will probably contain five-year-old information or worse by 2002. Using the current edition of a book (authors regularly update their books and each update becomes a new edition) helps to minimise this problem.

3.2.2 Scientific journal articles

Journal articles are the bread-and-butter of scientific reporting. Thousands of journals exist, each publishing new work in a specific scientific field. Most journals are peer-reviewed—this means that, when an author sends a manuscript to a journal, independent experts in the field read the submission to determine whether the work reported is valid and useful or not. If so the manuscript is published as a paper or article.

Different journals naturally have different standards, and the question of what constitutes a ‘reputable’ journal is a problematic one—people working in the field know the difference, but from outside it’s not always obvious. In South Africa an aid to the researcher is the national ‘SAPSE’ list of approved journals, which is updated yearly.

Articles published in reputable journals have a number of advantages as sources of information. First, such articles tend to be significant as well as reliable, because in order to be published in the journal they have gone through the peer-review process. Second, journal articles reflect more recent work than textbooks: just as the textbook may be seen as the base for information in a field, so the journal provides the ‘top-up’ of new information as and when new results are reported. Unfortunately, the staggering increase in scientific progress has led many prestigious journals to receive papers faster than they can publish them, and so waiting lists have become a feature in the very place where one expects to find cutting-edge results.
3.2.3 Conference proceedings

Conferences are gatherings of researchers in a particular field where scientific results are presented as papers. These conferences enable established and budding researchers to interact, and also promote the rapid dissemination of the latest results. Many conferences publish proceedings, which are collections of the (major) papers presented at the conference. Proceedings are a highly valuable source of the most current information. A drawback is that, because many conference proceedings are not as stringently peer-reviewed as journals are, the articles might not always be as reliable.

3.2.4 Theses and dissertations

Theses and dissertations are the finished product, or ‘write-up’, of Masters and Doctoral candidates. In some institutions a thesis refers to a Masters report and a dissertation to a Doctoral one, while others have it the other way around, and the rest use one of the terms for either form of report.

Masters and Doctoral theses/dissertations are generally stored in institutions’ libraries and are available via Interlibrary Loans (see 3.3.1 below). Apart from their use as reference works, postgraduate students should also check these reports in order to ensure that a topic of study hasn’t ‘already been done’. Sabinet searches detailing current work at Southern African institutions can be useful in this regard.

3.2.5 Company reports

Many companies commission scientific research into practical problems. The results of such research are typically described in a company report prepared by the researcher(s) for the company. These reports can be a valuable source of information if the company is willing to make them available—obviously, commercial or security concerns often preclude this.

3.2.6 People

If you know that Ntombifuthi Khumalo at the university down the road (or across the country or across the world) is working in the field you intend researching, it makes sense to speak to her. Apart from providing useful preliminary results on the problems she is working on, she might also have useful insights into ways of tackling your problem. The key rule here is to ensure that the people you speak to are in fact experts in the
field—asking Joe Bloggs the butcher for his advice on nuclear power plant design is clearly pointless and possibly dangerous.

3.2.7 Magazines and newspapers

Some magazines (e.g. National Geographic) have strong track records of reliable reporting, others (which we leave the reader to name) are less reliable. Magazine and newspaper reports are rarely used in research except as stepping stones in tracking down more reliable information. Generally a first publication of a scientific result in a magazine or newspaper (as opposed to a magazine or newspaper reporting on what has already been published in journals or conference proceedings) should be treated with great caution.

3.2.8 The Internet

The global network of computer networks contains many millions of files of data (including books, articles, reports and results). The Internet is an excellent way to try to track down information, but since one cannot always be sure of the correctness of the data on a site, it should not be a large-scale source of information itself.

3.3 ACCESSING INFORMATION

There are three steps to obtaining information: finding out which reports (books, articles, etc) are useful, obtaining copies of them, and then reading them. Ways of determining if something promises to be useful include:

- The title of the report
- Abstracts—most articles and papers have brief abstracts which summarise the key points; reading through the abstracts is a quick way to determine the relevance of the work to your own topic.
- Work referenced by other people—the idea here is that, if you find a report particularly useful, then the sources that the writer of that report used are also likely to be useful. A list of such sources (‘references’) normally appears at the end of a scientific report.
- Summary publications—in many fields there is a journal or organisation which keeps track of new works published in a particular subject and provides regularly updated summary lists.
Places to obtain the actual reports are described next.

### 3.3.1 The library

Your institution’s library is always the best place to start—many postgraduates are surprised to find out the scope of resources available at their own libraries. Your subject librarian can be enormously helpful in obtaining information for you—saying ‘please’ and ‘thank you’ a lot is highly recommended. Apart from the books your library stocks, and the journals it subscribes to, virtually any book or article in the world can be obtained by your library via a service called Interlibrary Loans. Many libraries stock CD-ROM databases of articles in particular fields.

Your library will have facilities for searches (such as Sabinet or DIALOG) of local and international databases. These are searched for keywords (specific terms relevant to your topic) and you receive abstracts of all the papers where those keywords appear. From the abstracts you can decide which papers you want your library to order for you. It takes some experience (which your supervisor and subject librarian can provide) to ensure an effective search.

### 3.3.2 The Internet

For many people, the biggest problem in using the Internet is that there is too much data available, and it is a problem sifting out useful information from irrelevant data. The various search engines often suggest many sites that sound relevant but turn out to be useless. One useful place to start is the specialised associations or societies in your particular field.

Another place for getting information from the Internet is newsgroups. There are thousands of newsgroups, each devoted to a specific subject of interest. Apart from reading the communications of other people, you can also ‘post’ (send) your own contributions or questions to the group—the help of people around the world can thus be enlisted. When new to a newsgroup you should:

1. ‘Lurk’ (just reading news items) for a couple of weeks on the newsgroup before coming in with your own questions and comments—it is rude to ‘speak’ and not ‘listen’ whether you’re communicating verbally or electronically.

2. Read the FAQ! Most newsgroups have a Frequently Asked Question list which is designed to give new members an idea of the group’s function and interests, and
to answer common questions. If you waste everyone’s time by ‘posting’ a question which is answered in the FAQ you can be sure of a very negative response. At best people will ignore your question (and you), more likely you will be ‘flamed’ (badly insulted) and in the worst-case scenario your computer could suddenly find itself flooded with ‘junk’ files. (The latter is only done to people who are very obnoxious, so there’s no need to worry if you avoid being so.) The latest copies of FAQs for all newsgroups can be FTP’ed from an archive address such as rtfm.mit.edu

where

mit = Massachusetts Institute of Technology
edu = Educational institution
rtfm = Read The (Fine?) Manual.

3.3.3 People

Communication with researchers in the field allows you to check progress in the field and to acquire information or reports which aren’t otherwise available. Such communication could be by normal (snail) mail, but it is more efficient to communicate via electronic mail (e-mail). The e-mail address of an author might be obtained from an article or book, or by using a browser on the Internet to access the electronic ‘phonebook’ at the author’s institution.

3.4 MAKE A RECORD

‘Someone I read said something like...’—this sort of phrase will not endear you to fellow researchers. From the start you should keep accurate records of any information you receive by making a summary of each report. Your records should also include the information you need to reference each source (see Chapter 13 for details), i.e. the title, the author(s), the year of publication, and

for books: the publisher and place of publication;
for journals: the journal name, volume and number;
for proceedings: the conference name and place.

You must have some system to organise your records—if your information isn’t organised, your thoughts won’t be either.
Discussion questions and exercises

1. Distinguish among the eight sources of information and give advantages of each. Can you think of some sources we have not mentioned?

2. Go to the library. Locate your subject librarian. Say ‘Hi’.

3. Find out what databases are available for your field.

4. Get yourself connected to the Internet. Find the newsgroup for your favourite sport and lurk (probably rec.sport.yoursport).

5. Read the FAQ for the newsgroup above.

6. Read the South African constitution via the Internet. (Try http://www.constitution.org.za)

7. Browse the Internet for items concerning your academic field (e.g. quantum mechanics).
4 Academia & Accounts

In this chapter, we consider the special case of a researcher undertaking research as part of his or her postgraduate studies.

4.1 ACADEMIA

The major academic institutions in South Africa are universities and technikons. Here you can not only do research, but also get an internationally recognised postgraduate qualification for doing it.

Traditionally, the universities have been portrayed as the bastions of pure research and the technikons the hives of applied research. Indeed in South Africa, national policies indicated that applied research should be the domain of technikons while pure research should be that of the universities. The overlap between pure and applied research, together with a move by universities towards tackling more relevant problems, has resulted in this distinction being no longer valid (if it ever was).

4.1.1 Degrees

There are several degrees available through postgraduate study including Masters and Doctorates. Traditionally the South African Masters was entirely based on one project (culminating in a thesis or dissertation). Recently, there has been movement towards incorporating course-work elements in the Masters program, up to half the content may be advanced courses in the field. This is in line with Masters programs in most other countries. Many institutions and faculties also offer purely course-work Masters programs; since these do not involve research we ignore them here.

A four-year degree is generally required for entry into a Masters program, though occasionally considerable years of relevant experience will be considered as a substitute. The four-year Bachelor of Technology degree at a technikon allows entry into a Masters of Technology programme. Four-year Bachelor degrees (e.g. B.Sc. Engineering degrees), or Honours Bachelor degrees, at a university allow entry into Masters programmes. A great deal of work is being done to allow easy movement of students from one institution to the other (AUT94).

The culmination of academic progress is the Doctoral degree. This is a degree which is based on a single work of research which is supposed to be a significant and original contribution to humankind’s knowledge.
A Masters degree may be thought of as a guarantee to the international community of scientists in the relevant field that they would not be wasting their time to talk to the holder. A Doctorate is a guarantee that they would not be wasting their time if they were to listen. (Mau83)

Doctoral degrees have different titles in different institutions and fields. In Technikons all doctorates are D. Techs (Doctors of Technology). Most common in universities is the Ph.D., or Doctor of Philosophy. This does not mean that the subject field of the doctorate was philosophy—Ph.D.s are awarded in Engineering, Science, Commerce, Humanities and so on—but rather reflects the original and significant thought in the field necessary for the award of the degree. Field-specific names are also sometimes used for Doctoral degrees (e.g. Doctor of Education). Honorary Doctorates are occasionally awarded to distinguished women and men who have made major contributions to society in areas such as human rights, philanthropy, service, etc.

It is perhaps worth mentioning here that physicians (medical doctors) do not in general hold doctoral degrees. The M.B. Ch.B. awarded to physicians in South Africa is actually two Bachelors’ degrees—Bachelor of Medicine and Bachelor of Surgery (Ch from the Latin ‘chirurgia’ for surgery). Society accords physicians the title ‘Doctor’ as a mark of respect.

4.1.2 Researching towards a postgraduate degree

You need to choose an institution and a department. No one department in any institution in the country is the best in all fields of a subject: different departments have different specialisations. Ideally you should choose a department which specialises in the field you wish to research —of course, this might well be the same institution where you did your undergraduate studies.

The process of enrolling for a Masters programme varies from place to place. In general you apply to the relevant faculty or department to be admitted to the Masters program, and, depending on whether they have the necessary expertise in the field, they say yes or no. At some stage a formal research proposal (see Section 14.2) is required—in some institutions a full proposal is required before actual registration. This proposal will be written by yourself with the aid of a mentor.

The word mentor here covers supervisors, advisors and promoters. A mentor guides you through every stage of the academic process: from setting out to find a topic until the examined thesis lands on the dean’s desk several years later. They are there to deal with every manner of academic problem. (Be gentle on them though: while you can devote yourself fully to one research project, they may have several students and
courses to teach, and research projects of their own.) So aim for one who is concerned about you, interested in your field, competent, has reasonable expectations, reads your drafts in a reasonable amount of time, and gives consistent advice.

In addition to your departmental mentor, sometimes an additional mentor, whose specialist knowledge can contribute to your work, is appointed from outside your department, faculty or even institution. While the choice of mentor is often determined by the choice of area of research, it should be noted that one’s mentor, especially at the doctoral level, can have considerable influence on one’s career (finding jobs, writing letters of recommendation). They can also become important research collaborators.

Getting a postgraduate degree can at times be hard going and frustrating. However, the ‘Eureka!’ and the pure sense of achievement will be one of the greatest thrills of your life.

4.2 RESEARCH FUNDING

You also need money. Research is often expensive. Most researchers rely on three main sources of funding—their own institution, funding bodies, and industry.

Different academic institutions have different mechanisms for funding research. These range from scholarships and paid graduate assistant posts for postgraduates, to grants and even salary subventions for staff members. Check what is available at your institution—if you don’t ask you won’t get.

Two major statutory bodies fund research. The National Research Foundation (NRF) includes the old Foundation for Research Development and Centre for Science Development and supports research in Engineering, Science, Humanities and Commerce. The Medical Research Council (MRC) supports medical and related research. Sometimes there is an overlap of interest, for example an engineer working on the design of a new device for laser surgery.

These bodies offer a range of support programmes for research which financially support specific research projects in approved areas and provide scholarships for Masters and Doctoral students. Such scholarship awards take into account the student’s undergraduate results as well as the supervisor assigned to the work. The NRF is currently providing additional support to encourage applied research and to promote research cultures at the technikons and previously disadvantaged universities.

Almost all opportunities require a proposal for your research. This should be carefully written and should be realistic. Asking for a million rand for a piece of equipment for the writing of one thesis will not succeed.
Discussion questions and exercises

1. Find out what areas your department specialises in. Now go to a neighbouring institution and find out what they specialise in.

2. Visit the website www.nrf.ac.za