Introduction

What contributes to good research?

- It is important to learn to distinguish good research from poor research, and to assess the strengths and weaknesses of each.

- Good research will in general make its aims and objectives, claims and limitations clear.

- Poor research may be unsound for many reasons, e.g. literature review, experimental methodology, analysis of data, reporting, etc.

- Poor research may nevertheless contain the essence of a good idea.

- It can take skill and imagination to spot such hidden useful nuggets.
Literature Review

The usual starting point for research, whether or not you are starting with a clearly defined research problem, is to read about the subject:

- find out about the background.
- identify unanswered questions or controversies.
- can lead to small scale investigations or pilot studies.

Once the problem is defined it can be broken down into a set of specific questions or hypotheses.

Breaking down questions and hypotheses is referred to as “operationalizing”; this should help suggest the most appropriate line of investigation.

Exercise: scan (do not spend time reading them in detail!) through some research papers or existing dissertations or theses.

Ask yourself.

- Does each one seem to define the research problem explicitly, e.g. as a list of hypotheses?
- Does the focus emerge as the research progresses?
- Is there any indication that the research problem changed in direction or emphasis during the research?
Research Methodologies

- A research methodology is a rationale for gathering and processing data, deciding on what sequence and what data to use.
- It is a well informed and argued case for designing a piece of research in a particular way.
- Good argument involves paying attention to counter arguments, and in general justifying your choice against the alternatives.

Exercise: Look for how the methodologies are argued for in some papers and theses, do the arguments seem reasonable to you? are there omissions or unfounded assumptions?

Competence in Research

Data collection in research investigations needs to be as relevant and accurate as possible.

- Can inspire confidence in the solution.
- Sometimes something important can turn up leading to a new and important line of investigation. Such observations can only be trusted if the data is known to be accurate.
- Constraints of time, location or availability of resources can prevent a data collection exercise from being repeated!

Exercise: When reading papers and theses consider whether you think that the investigations have been competently conducted.
A paper or thesis should be much more than a presentation of the data collected or a report of the work carried out.

It should be a well-documented and well-argued case for one or more specific solutions to a research problem.

The notion of arguing a “case” in the manner of a lawyer can be useful here.

To make a case:

- evidence has to be collected and presented to take the argument forward.

- evidence can be from the literature (properly acknowledged) or data collected in your research.

- It is vital to distinguish between existing work from literature and your own work - plagiarism is a serious offence in research degrees (and in research in general).

- Counter arguments need to be explored and dealt with rigourously and fairly.

- The language in which the case is argued should be precise and clear, and not be clouded with irrelevancies.

- Selecting what to include and what not to include requires careful thought.

- A thesis or paper should develop the argument like a lawyer; not report events like a journalist!
When reading a research article try to identify the case being made for the presented research.

Look in particular at:

- the abstract.
- the first and last paragraph of the article.
- the first and last paragraph of each chapter or section of the report.

Do you find the arguments convincing?

Do you feel anywhere that the cases are blurred with “padding”?

Do you feel that counter arguments are dealt with fairly?

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**Research Outcomes**

- Research sometimes throws up important unexpected findings which can change the anticipated direction of the research.

- You should be alert to this possibility in your own work.

- In order to spot unexpected results, you should try to predict what sorts of outcomes you expect to see.

- If something unexpected does turn up, you should then be able to spot it, recognize its potential significance, and consider whether to change research direction.
Use of Literature

- Literature should be used as “evidence” to support argument and counter-argument in building a research “case”.

- Mere lists of references in a catalogue style are not acceptable.

- Direct quotations should only be used for purposes of illustration, not to replace your own original case.

- But, in a thesis you need to show a thorough reading and knowledge of the field, so you need to work carefully to bring references to other work meaningfully into your discussions.

Use of Literature

Exercise: Look at the citation of literature in papers and dissertations.

To what extent is the literature used:

- merely to illustrate knowledge?
- as evidence to make or support a case?
- a mixture of both?

What type of case are they supporting:

- gap in knowledge?
- suitability of research design?
- validity or limitation of data, findings, conclusions?
- something else?
Use of Data

Presenting data is not enough.

It has to be processed and meaning imposed on the findings.

Exercise: Scan papers and dissertations.

- Has the data been processed appropriately?
- Have the authors argued the cases for their findings or conclusions meaning something?
- Is there any argument for the limitations or conditions for which that meaning is valid?

Originality and Significance

- A thesis or research article should make its claim for original contribution clear, even if only implicitly.
  - In general it is better to state your claims to contribution clearly and succinctly in the Introduction and Conclusions, so that there is no chance of the examiner or reviewer missing them!
- The higher the level of degree (or publication!), the greater will be the expected degree of significance.
- Sometimes significance is clear, other times it is not, and examiners (or reviewers) may sometimes disagree over the contribution of the work.
**Reliability of Research**

If other researchers can repeat a piece of research and obtain the same results, it is said to be entirely *reliable*.

Experiments with human subjects based on subjective answers, e.g. happy, tired, cannot be exactly replicated by others in other places at other times.

For numerical data the results are generally reproducible, although there may be questions over the reliability of numerical values, e.g:

- the competence with which the data was collected.
- consistency of the instruments used to collect them.

**Validity of Research**

Where a piece of research achieves its objective it is said to be valid.

Valid and reliable can be hard to achieve at the same time.

Consider student assessment.

- The most reliable form is tick-in-the-box answers, since they will always be marked the same.
- If an important part of the assessment is to understand thought processes, as well as outcomes, essay questions are more valid.
- But marking essays will be less reliable, since opinions may vary.

Reliability can be increased, e.g. by double marking.
Creative Thinking in Research

- Research is often thought of as involving only logical analysis.
- While logical analysis can be used as a critical tool for the refinement of ideas, new ideas themselves often originate in very different ways: metaphor, analogy, hunches, etc.
- Creativity in research can be encouraged through the use of various techniques - some obvious, some not so obvious.

How Does Intellectual Creativity Work?

Common elements of a creative solution for most people:

- There can be considerable time spent “mulling over” the problem before arriving at a solution.
  - There is no way of predicting how long this might take!
- The idea for a solution just “pops into their head”.
  - Usually when they are not thinking about the problem, or probably anything else either.

Once the creative part of the problem solving is over, hard ground work needs to be done to develop a real practical solution to the problem.

The following are some techniques which can prove useful in developing creative research.
Talking Things Over

- Talking things over with other people not only provides the benefit of their views and ideas, but people often find that the very act of talking seems to stimulate their own thinking.

- You may choose to talk with an expert in the field in order to get their ideas or comments.

- However, this is not necessary if you are talking things over to facilitate your own creativity.

- The person merely needs to give you their time and commitment to listen to what you are saying.

Keeping an Open Mind

It's easy to close your mind to alternative solutions or interpretations of the data available to you.

Try to keep an open mind by doing the following:

- identify all the unlikely or seemingly implausible interpretations and consider if any might have any validity.

Keeping an open mind is particularly important when talking to others; without it, one is liable to “hear” (i.e. “take in”) what one is expecting to hear or what one already knows, rather than what might actually be said.
Brainstorming

- This is a well known problem solving technique, but may not always be useful in academic research.

- Brainstorming is normally carried out in groups, but can be done individually.

- It consists of listing as many ways to move the situation forward as possible, however improbable each suggestion might be, without pausing to evaluate them.

- Only when the list is complete is the value and feasibility of each possibility considered.

Negative Brainstorming

This can again be done individually or in a group.

Negative brainstorming can be useful for solving academic research problems.

- List as many ways as one can think of not to achieve the objective, and then, when the list is complete, consider whether reversing any of them might be productive.

- This may seem a useless idea, and many of the reversed ideas often turn out to be meaningless.

- Nevertheless, negative brainstorming really does have a proven worth, it can produce ideas that would never have been thought of via more direct methods.
Viewing the Problem from Imaginary Perspectives

Imagine solving the problem in a different time or place.

(Einstein is said to have started work on this theory of relativity by giving his imagination free rein and wondering what it would be like to ride on a light ray.)

**Concentrating on Anomalies**

- Don’t ignore results that don’t fit the theory.
- Concentrate on anomalies and see if they represent something worth investigating.

**Focussing on Byproducts**

Look for unexpected results, e.g. unpredicted trends within your results.

Even if your results fit your existing theories, look among them to see if there are any other unexpected trends or details which suggest further investigation and/or might require an extension of existing theory or a completely new theory to explain them.

**Interrogating Imaginary Experts**

Imagine you are to interview an expert in your field. What questions would you ask?

Just developing the questions can open up unexpectedly original and valuable ways forward for your research.
Viewing from the Perspective of Another Discipline

Talk the problem over with people from other disciplines to see how they would approach it.

They may not technically fully appreciate your problem, but their comments and ways of exploring the problem may inspire new insights or research ideas.