Part 1: Introduction to Research

CA546/CA625: Research Skills

MSC in Software Engineering
European Masters in Business Informatics
MSC in Bioinformatics

School of Computing
Dublin City University

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Why Research Skills?

Preparation for the MSc Practicum (CA545/BEE54/CA635/CA623)

- Reporting your findings
- Analyzing results
- Planning the investigation
- Literature review
- Forming a research hypothesis

Why Research Skills?
Why Research Skills?
Some Questions

At the start of your postgraduate studies:

- How am I going to make sure I achieve this?
- What do I intend/hope to get out of postgraduate study?
- Why did I choose this course over others?
- Why am I doing a Diploma/MSc?

If you have not done so before, you may find it useful to consider these questions.
This module will give you the opportunity to develop the following Transferrable Skills:

- Locating sources of information.
- Reporting results (considering the audience, written reports, oral presentation).
- Review, reinterpretation, contrastive analyses and summarized reporting of existing work.
- Locating sources of information.
- Team working.
- Planning (work plans, time plans).
- Transferrable Skills, and probably others as well.
shouldn’t treat it as simply an extension of undergraduate study.

Postgraduate Study

You should not feel restricted to only studying the course material. e.g. if a topic is interesting feel free to read beyond set material.

- although of course you need to focus on the syllabus and make sure you pass all the assessments!

- potential employers/research supervisors will often look beyond your qualifications to find out about your real interest in a subject.

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- Plan to take responsibility for your learning.

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Introduction to the Research Process

Research is an original contribution to knowledge.

- Or the sequential or incremental testing of a number of smaller hypotheses.
- A project may involve the testing of a single (possibly quite complex) hypothesis.

A project involving the testing of a single hypothesis:

- If a and b occur with c, then they should occur with d as well.
- If x is true then y must be true as well.

Involves developing and testing an hypothesis.
Introduction to the Research Process

Research projects usually involve a cycle of forming and testing hypotheses. Knowledge by hypotheses and testing.

Thus research in a topic area is often a never ending process of extending.

If the current hypothesis is found to be true, then it is often refined or extended to form a new hypothesis that needs testing.

If the current hypothesis is found to be false, then the next stage is to refine the hypothesis or to develop a new hypothesis which explain the result. This new hypotheses then needs to be tested.

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Fortunately, research degrees and even larger projects only need to make a

appropriate contribution to be deemed successful.
Assessing Contribution

Appropriate contribution varies depending on the qualification sought.

- MSc/MPhil requires less than PhD.
- MSC/MPhil requires less than PhD.

At the end of the day the decision of success or failure rests with the examiners.

Qualified researchers continue to face this situation repeatedly every year.

- Personal guidance on this should be available from your research supervisor(s).
- It is also a good idea to look at some existing successful dissertations for the same degree from previous students from your course or School.

Reviewers will read and accept or reject their submission if they submit work for publication or proposals for research grant applications. Reviewers will read and accept or reject their submission if they submit work for publication or proposals for research grant applications.
A postgraduate research project is a training qualification in conducting research within your discipline (physical sciences, social sciences, arts, etc., can be quite different in their approaches). Reflection on your experience is an important part of the learning process. So you might usefully ask questions such as:

- Did I rush to speak to my supervisor too quickly?
- Did I wait too long to discuss this problem with my supervisor?
- Was this the best design of experiment possible to make maximum use of my time?
- Did I start the experimental without sufficient literature review?
- Did I spend too long reading before starting the experimental work?

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Research Projects

A research project may be very clearly defined at the start with a well-defined single hypothesis or series of hypotheses to be tested. At the other extreme, a research project may only be vaguely defined. Supervisor decides "this is an interesting area to work in, there are lots of interesting and unsolved problems, let's start work and see where it leads us." The first option is generally "surer", but often less exciting with less scope for significant personal contribution from the student.

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A word of caution.

Beware just being the eyes and hands of the supervisor in the laboratory.

If you are concerned that you are not getting enough support and guidance, or that you are not getting enough freedom to develop your own ideas, discuss your concerns with someone.

- Your supervisor
- Your course director
- The practicum coordinator
- Your friends/collleagues...

...whenever you are most comfortable talking to.

It’s great to get strong and enthusiastic support and guidance, but you will be assessed on what you have done.

Research Projects
Getting Started: Familiarity with the Literature

Goal: Find out what has already been done. And who has done it.

would be timely for some reason.)
repeat existing work if you believe it be deficient or that a reassessment
helps prevent you repeating existing work! (although you may want to
helps in identifying and understanding methods.
identifies new and current approaches and trends.
delimits the research problem.

This is vitally important since it:
Getting Started: Familiarity with the Literature

Relevant literature can come from many sources:

- Increasingly the Web.
- Bibliographies/Books.
- Dissertations.
- Journals/conference proceedings.
- List of abstracts, etc.
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Getting Started: Familiarity with the Literature

- Synthesize and reference.
- Keep review up-to-date as you find more references.
- Beware „common knowledge“.
- Evaluate content over style.
- Contrast sources and types of knowledge.
- Work backwards - z cites y which cites x - can lead to the key sources.
- Be open minded.

When reviewing literature:
Identifying a Research Question

- Why are some topics/measurement/variables difficult to learn/make?
- What can be learned by studying current practice?
- Why is a particular experiment/methodology less than satisfactory?
- Observe:
Identifying a Research Question

- Derive
  - inspiration from published work, e.g. seek to verify, replicate, refute,
  - apply existing theory to your work,
  - extend
  - correct methodology in earlier work.

Resolve conflicting or contradictory findings.
Identifying a Research Question

- Unresearchable topics: Is the topic amenable to methods proposed?
- Trivial topics: Is the answer obvious? Will you learn anything? Is there any contribution to knowledge?
- Overworked topics: Do you have a new slant?
Identifying a Research Question

Consider:

Personal Factors:

- Interested?
- Unbiased?

General Factors:

- Equipment, tools, participants, time available?
- Background and skills?

Will the data/method be applicable, new, worth having?
Some Common Mistakes

- Failure to make assumptions explicit, recognizing limitations of approach.
- Permitting no expansion or generalization.
- "One Shot" Research - conducting research unique to a given situation.
- Poor Review of Professional Literature.
- Fitting Questions - to a "batch" of data.
- Data/Method - without defined purpose.
- Poor Bases - unsupported claims and assumptions.
- Poor definition of context - lack of theoretical or conceptual framework.
- Anticipate alternatives.
Exploring the alternatives sufficiently.

- Compromising. Limiting the scope of the investigation too soon. Not
  (really!?) arriving? Will it be here soon enough?
- Availability of data, software, equipment. Is it here now? When will it
  arrive?
- Time Available: everything takes longer than you think!

Some Common Errors in Planning
Researchers have good days and bad days. Some things work out and some things do not.

Negative results can lead to the greatest insights or new ideas.

Research can be highly creative, rewarding, personally satisfying and even fun!