

KING SAUD UNIVERSITY
COLLEGE OF ENGINEERING
CIVIL ENGINEERING DEPARTMENT
MSC in Engineering and Construction Management
Individual Research Dissertation

LECTURE OBJECTIVES:

- To enable students to gain confidence in selecting an appropriate research topic, plan and methodology for their dissertation.
- To understand the purpose and processes involved in undertaking a literature review.
- To practice setting aims, outcomes and objectives for their dissertation as an integral part of both planning their work programme and developing a systematic approach to their research.
- To identify their own interests together with their personal strengths and weaknesses which will either assist their progress or be barriers to be overcome.

LEARNING OUTCOMES

By the end of the Workshops One and Two, the students should:

- Be familiar with the research process.
- Understand the stages in writing a research proposal.
- Be familiar with the principles of linking theory and practice in research.
- Have explored methods for selecting research projects.
- Have identified key personal strengths and weaknesses in undertaking a dissertation and thought about ways of overcoming difficulties.
- Be able to define an objective and explain its purpose and characteristics.
- Be able to define a hypothesis and determine their relevance to the research.
- Have developed a hierarchy of objectives and associated output measures relevant to their research dissertation.

1. INTRODUCTION

1.1 What is research?

“The systematic investigation into and study of materials and sources in order to establish facts and reach new conclusions.”

and

“Discover or verify information for use..”
(Oxford English Dictionary of English (2005) p. 1497).

“Finding out things in a systematic way in order to increase knowledge about people and processes involved in the management of work organizations.”
(Anderson, V. 2004, p.6)

You may add to the above definitions the phrase ‘to increase knowledge and underpin effective action.’

1.2 Type of research

Grinyer (1981) in Howard and Sharp (1983) suggests that there are four types of research by nature and contribution to knowledge:

- I. Pure theory**
- II. Testing of existing theory**
- III. Description of state of the art**
- IV. Specific problem solution**

In relation to management problems, Grinyer notes that the original contribution to knowledge decreases as one moves down the list, but that the chances of successful completion increases as we go down the list. A common approach to MSc research projects is to combine stages three and four in a research topic.

2. THE NATURE AND CONTEXT OF RESEARCH

Fellows and Liu (1997) state that each individual package of research is itself a project involving enquiry and learning. Research always takes place in a context and these contextual or environmental factors must be considered as well as the subject variables as they may influence results through

impacting on the data collected as occurred. Subject variables of the topic of study are dependent, independent and intervening variables.

2.1 Subject variables

Dependent variable The key factor (or object) of the topic of study which responds to a change in the independent variable.

Independent variable Independent factors which are changed or analyzed to assess their impact on the dependent variable.

Intervening variable Variables over which the researcher has no control but may affect the dependent variable.

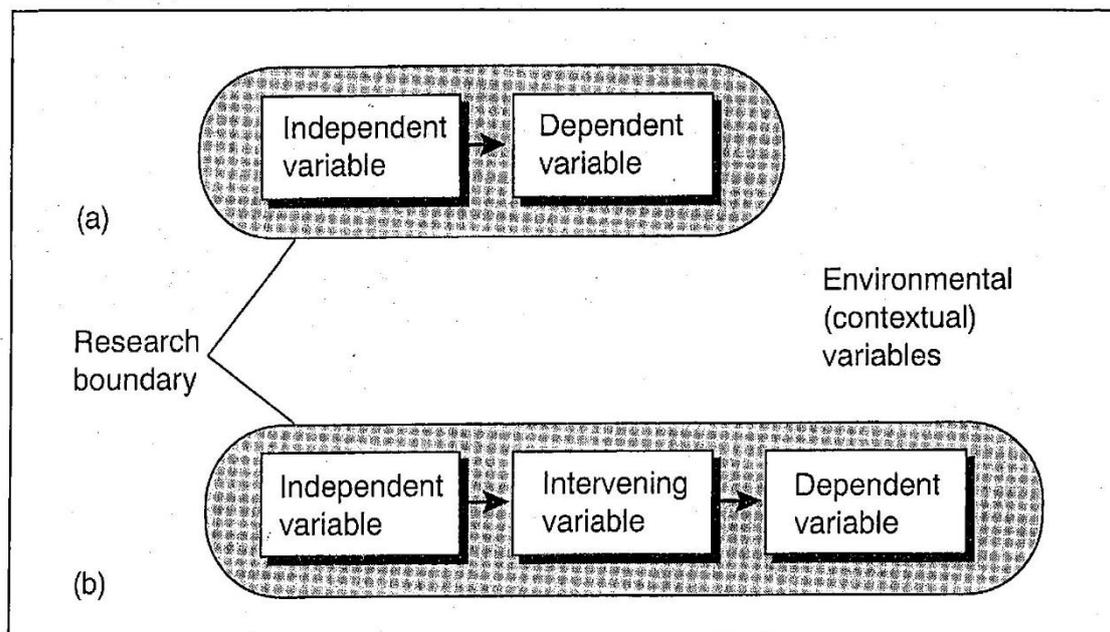


Figure 1. Causality Chain between variables (Fellow and Liu, 1997)

2.2 Subject hypothesis:

According to Verma and Beard (1981), hypothesis is *“a tentative proposition which is subject to verification through subsequent investigation ... In many cases hypotheses are hunches that the researcher has about three existence of the relationship between variables.”* (Anderson, 2004)

3.0 Research Methodology

“refers to the principles and procedures of logical thought processes which are applied to scientific investigation.”

Fellow and Liu note that the key questions relating to the implementation of a research project are:

- **What?** – topic selection and level of detail
- **Why?** – reasons for conducting the research
- **Where?** – place of research
- **When?** – produce a timetable
- **How?** – is the issue of methodology (research design)
- **Whom?** – the personnel or groups involved in the research
- **How much?/How many** – resources that can be used

These questions must be addressed explicitly, noting requirements, constraints and assumptions.

3.1 Type of research methodology

Quantitative approaches adopt ‘*scientific method*’ in which initial study of theory and literature yield precise aims and objectives with hypotheses to be tested.

However, *Qualitative approaches*, an exploration of the subject is undertaken without prior formulations – the object is to gain understanding and collect information and data so that *theories and patterns* might emerge. Rich data can emerge from qualitative data.

Triangulation approaches presents the use of qualitative and quantitative techniques together to study the topic – can be very powerful to gain insights and results, to assist in making inferences and in drawing conclusions (Fellows and Liu, 1997).

In all cases rigour and objectivity are vital

* *Example of triangulation*

- The use of *different research methods* in the same study to collect data so as to *check the validity of any findings*.
- The collection of different data upon the same phenomena, sometimes using *different researchers* so as to *validate findings*.

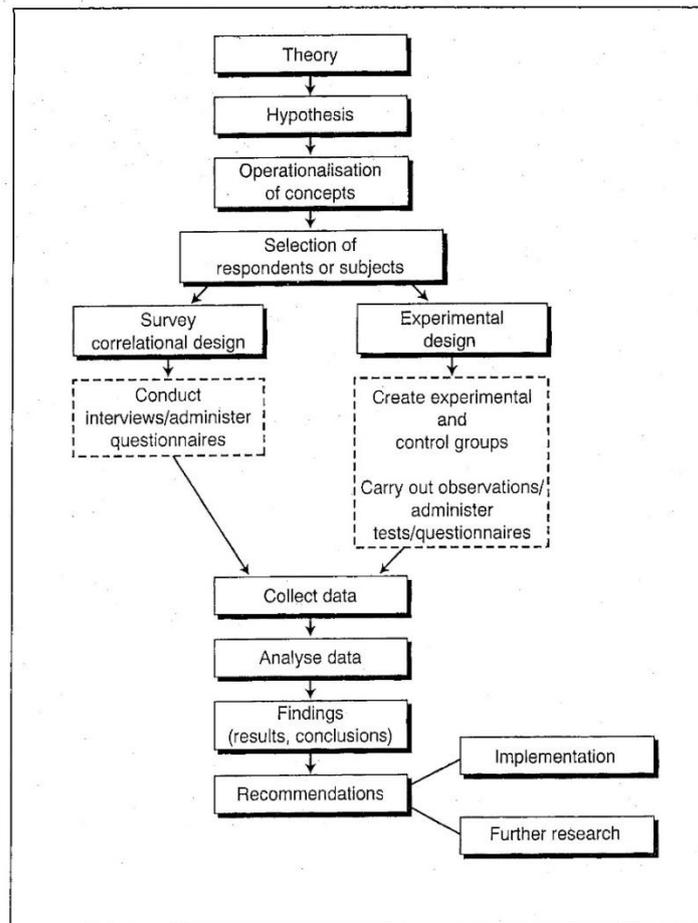


Figure 3. Quantitative and qualitative research (Fellows and Liu, 1997)

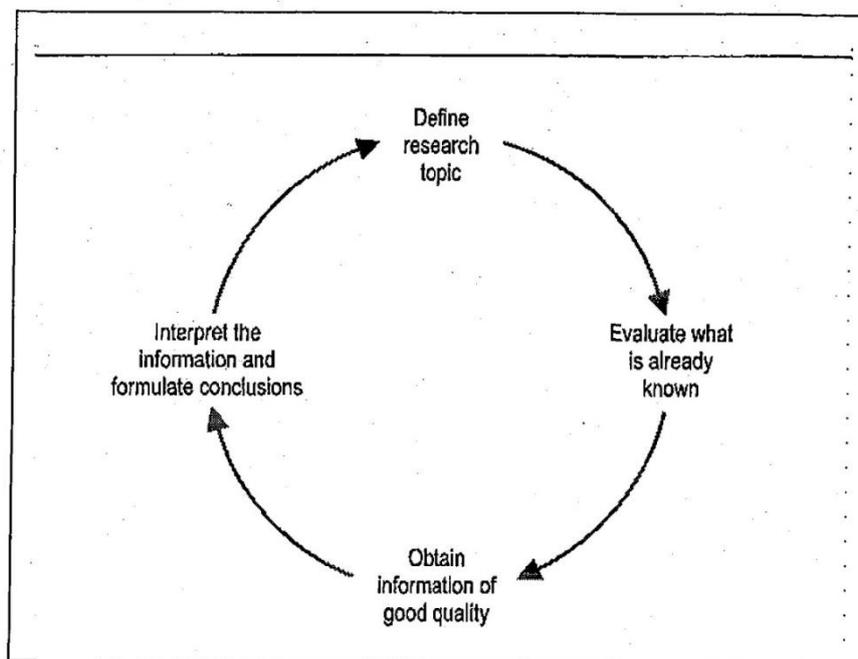


Fig. 4: Components of the research process (Anderson, 2004).

5. TOPIC SELECTION

The topic or question of your research needs to be identified and then refined so that it is manageable within the time and other resources available. Number of researchers (Fellows and Liu, 1997, Howard and Sharp, 1983) identify/suggest lists of factors to help with identification of feasibility of research proposed. These factors comprise:

- Topics of interest
- Availability of and access to data and information
- Personal/knowledge strengths and weaknesses
- Research limitations or risk involved
- The time and financial support needed to complete the research

Topics of interest will include those that are relevant to your future career. Topics of interest also arise from your past experience.

Access to data is crucial and may determine both your topic and the design of your study. This is therefore, a vital consideration at the planning stage. The most challenging part of many people's research project is gaining access to respondents in their field of study. Your existing contacts or the contacts you can develop are vitally important here.

Need You may be concerned about a particular issue or problem that needs resolving in an organization, area of operation or geographical area known to you.

Personal strengths and weaknesses Common problems are a failure to plan, beginning fieldwork without an adequate literature review and underestimating the volume of work that is required to meet project objectives.

5.1 Refining your topic: Further thoughts on determining the research questions(s)

Once you have decided on a particular area of study of study or research topic, you will need to focus your study on the precise aspect of the topic you wish to explore. You may find it difficult to decide exactly what research question are you seeking to answer?

Therefore, the following questions need to be precisely answered to identify the added value of the proposed research topics and methodology:

ASK YOURSELF?

- What purpose does my research aim to fulfill?
- To what extent has qualitative and or quantitative data underpinned the enquiry?
- To what audience is the research directed?
- To what extent does this study engage theory (or models) with practice?

6.0 REFFINING RESEARCH QUESTION: SETTING THE AIM

6.1. What is an aim?

An aim is a statement of intent (what you *'intend or try to do'*: Concise OED 1982) set in a particular context. The purpose of an aim is to indicate to the reader the scope and purpose of the study so they know what to expect.

Fellows and Liu (1997) define the aim of a research project as follows:

“The aim of a research project is a statement of what the research will attempt to do – often in the form of what is to be investigated, which is more appropriate for qualitative research, or what impact the main independent variables are believed to have upon the dependent variable, an approach which is suitable for quantitative studies. The aim is really a statement at the strategic level The aim provides the identification of the context of what is attempted.”

7.0 REFFINING RESEARCH QUESTION: DEFINING THE RESEARCH METHODS

Yin (2003) states that defining the research questions(s) is probably the most important step to be taken in a research study. He notes that the research questions(s) should have both **substance** (e.g. what is my study about?) and **form** (e.g. Am I asking a “who”, “what”, “where”, “why”, “when” or “How” question?).

Yin (2003) discusses the relationship between the types of research question and different kinds of research strategies.

Relevant Situations for Different Research Strategies (Yin, 2003)

Strategy	Form of Research Question
Experiment	How, Why?
Survey	Who, What, Where, How Many, How much?
History	How, Why?
Case Study	How, Why?

7.1 Note on 'DATA'

Fellows and Liu state that it is vital that methodology is given careful consideration at the outset of the research so that the most suitable approaches and research methods are adopted. Attention should be given to 'DATA' (Definitions, Assumptions, Theories and Analysis):

- D *Definitions* of the main terms involved. Especially where the terms have varied definitions, it is essential to decide explicitly the definitions to be adopted, and why they have been adopted so that appropriate measurements can be made during the collection of data.
- A note the *Assumptions* that have been made and the justification for them.
- T research and critically review the *Theories*, principles and literature relating to the subject matter of the research.
- A evaluate what *Analyses* may be carried out with respect to the data available, the objectives and any hypothesis, so that the most robust and rigorous analytic methods will be used, thereby maximizing confidence in the results.

8.0 WRITING THE PROJECT (RESEARCH) PROPOSAL

Fellows and Liu (1997) suggest that the proposal should include:

- Title
- Statement of problem
- Aim
- Objectives
- Hypothesis
- Methodology
- Programme
- List of primary references

Diagrams or charts (e.g. for the programme or the methodology if this is determined at this stage) will be helpful.

9.0 USE OF SUPERVISION

Your supervisor is your ultimate guide to all aspects of your project including, most importantly, the whole issue of setting aims and objectives and deciding on an appropriate methodology for your study. He is an invaluable source of advice, and the guidance given in this workshop must be set in the context of the advice from your supervisor who is the ultimate source of authority, guidance and encouragement.

10.0 GENRAL ARRANGEMENT OF MAJOR RESEARCH THESIS/PRPOSAL

10.1 Main sections headings: each dealing with a particular aspect

SUMMARY	A very brief statement of the aims and scope of the research, with the main conclusions in ONE page.
LIST OF CONTENTS	A list of all main sections, major sub-divisions and appendices. Page numbers for the start of each section should be included.
1. INTRODUCTION	Describe the scope of the dissertation with a clear statement of the aims and importance of the project.
2. OBJECTIVES AND METHODOLOGY	A clear statement of the objectives that have to be done to meet the aims set up in the INTRODUCTION section, and the methodologies that you wish to use to achieve these objectives.

3. LITERATURE REVIEW	A comprehensive and critical survey of relevant published work related to the topic you selected in your project. Summarize the relevant published work (usually in chronological order). Add critical comments where possible, and compare the ideas expressed by the various authors. Comparison and criticism are the distinguishing features of a good essay.
4. CASE STUDY (questionnaire and interviews)	If you select a real project for investigation, a description of project is needed and what problems within this project related to your topic under investigation. A description of questionnaire design and interview question design.
5. RESULTS (OR FINDINGS)	A full summary of results found in CASE STUDY, tables and graphs can be used where necessary. Do not present raw data and information, but convert it to results which can be easily understood by the reader.
6. DISCUSSION	The most important section of the dissertation. Aim to prove to the reader that you understand the project and the significance of the results. Discuss your results and compare them with theoretical predictions and with other published results. Examine their possible effects on construction project. Indicate whether your work confirms or adds to existing knowledge.
7. CONCLUSIONS	State whether the original aims were achieved, and what extra work needs to be done. Suggest improvements to the project management.
8. REFERENCES	List all references quoted in the text or diagrams, in alphabetical order of first authors' names.
APPENDICES A, B, C, etc.	These may contain tables of results, or material of secondary importance such as derivations of formulas, computer programmes, subsidiary tests, etc.

10.2 Subsection headings

Major sections may be sub-divided if this improves the clarity of the text. Numbering of sections helps when cross-referencing. The following is a typical example:

4. CASE STUDY

4.1. Description of the Project

4.2. Questionnaire Survey

4.2.1. Questionnaire design

4.2.2. Industrial companies

4.3. Interviews

4.3.1. Interview question design

4.3.2. Industrial companies

However, excessive sub-division destroys the smooth flow of the text

10.3 Style

Aim to produce a clear, concise and accurate text, written in good English. Papers published in good scientific journals may be used as a guide to the arrangement and style expected. Write in the third person. Avoid colloquial expressions and witticisms. Omit or change meaningless jargon, and prune currently over-used words or expressions such as: unique, dramatic, realistic, complex, technique, “or whatever”, “at this moment in time”, etc. Carefully check spelling and punctuation. Misquoting or misspelling of references creates a very bad impression.

Number all Figures and Plates, and refer to them in the text. All references listed must also be referred to somewhere in the text or Figures. Number all pages, including those of the Figures and Plates. Number should be continuously through the whole Bound Report as in a book. Be consistent about headings, capital letters, spacing, margins, etc.

Check your draft before typing, and check the finished typescript several times before submission for binding.

10.4 Illustrations

- Drawings or diagrams in the text should be referred to as Figure 1, Figure 2, etc., and photographs as Plate 1, Plate 2, etc. They may be placed in the text near the first mention, or collected together at the end. Every Figure must be referred to in the text.

- Figures should be neatly drawn.
- Captions for Tables, Diagrams and Figures must be clear and unambiguous.
- Allow at least 30 mm clear space for binding on the left-hand edge of all pages, and 20 mm clear on other edges. With graphs, take care that the caption on the left axis is not hidden by binding. When presenting graphs, plot the original data on graph paper, showing all experimental results. Put ticks on the axes to represent leading values, caption the axes with words and any symbols used, and show the units of the quantities plotted. Add a few fine cross-lines to help the reader; a dense mesh spoils the effect. Distinguish between different groups of data by different symbols. Consider the data carefully before drawing a smooth curve or straight line through the points; smooth curves often obscure important trends.
- Photocopies of Figures from published work may be included, but acknowledge the source in every case. For example, a diagram from the book by Min An might be captioned:

FIG 8: A PROJECT RISK MANAGEMENT FRAMEWORK (Min An, 2008)

- Quote the full reference in the list after the main text. Include brief details about the material and test within each Figure or as part of its caption.

10.5 References

- If you include any fact or opinion which has already been published, the source must be given as a reference. The object is first to acknowledge previous publication, second to help the reader to find the original reference, and third to show your breadth of study.
- All references listed must be referred to in the text, or in the Figures; this point is certain to be checked by the Examiners.
- A reference in the text may be inserted in several ways, as shown in the following examples:

Bjerrum and Flodin (1960) have reviewed the development of soil mechanics in Sweden for the period 1900 to 1925.

Soil mechanics development in Sweden has been reviewed by Bjerrum and Flodin (1960) for the period 1900 to 1925.

Important development in soil mechanics took place in Sweden in the period 1900 to 1925 (Bjerrum and Flodin, 1960).

- If there are more than two authors' names, save space in the text by using the contraction "et al."; all the names must be included in the list of references:

The N.H.B.C. structural requirements for housing are described by Chapman et. Al. (1978).

- A general statement may be supported by a list of typical references, which need be exhaustive:

The application of statistical theory to soil mechanics has attracted much attention (Lumb, 1966; Benjamin and Cornell, 1970; Hoeg and Murarka, 1974).

- The method of listing references in the final Report should follow the school/university regulations. The following list includes the references already quoted above, and an example of a Ph.D. Thesis:

Benjamin, J.R. and Cornell, C.A. (1970). Probability, statistics and decision for Civil Engineers, pp. 1-684. New York: McGraw-Hill.

Bjerrum, L. and Flodin, N. (1960). The development of Soil Mechanics in Sweden, 1900-1925. Geotechnique 10, No. 1, 1-18.

Chapman, D.A., Dyce, R.E. and Powell, M.J.V. (1978). N.H.B.C. structural requirements for housing. Struct. Engr. 56A, No. 1, 3-10.

Hoeg, K. and Murarka, R.P. (1974). Probabilistic analysis and design of a retaining wall. Jnl. Geotech. Engng. Div. Am. Soc. Civ. Engrs. 100, No. GT3, 349-366.

Lumb, P. (1966). The variability of natural soils. Can. Geotech, Jnl. 3, No. 2, 74-97.

Stroud, M.A. (1971). The behavior of sand at low stress levels in the simple-shear apparatus. Pp. 1-306. Ph.D. Thesis, University of Cambridge. (unpublished).

Listing the references is usually the last operation in drafting a report or thesis, but Examiners and specialist readers often turn first to the references so that they can judge the scope of the work. First impressions are very important when a report is examined, and special care should be taken to present clear, accurate and consistent references.

10.6 Abbreviations

Abbreviation of the names of journals and conferences should be done in a consistent way. The following examples may be useful:

Publication	Abbreviated Form
Proceedings of the Fifth International Conference on Soil Mechanics and Foundation Engineering, Pairs.	Proc. 5 th Int. Conf. Soil Mech. Fdn. Engng. (Pairs)
American Society for Testing and Materials	Am. Soc. Test. Mater.
Special Technical Publication	Spec. Tech. Publ.

10.7 Copying

Copying from published work without acknowledgement is certain to lead to rejection of the submitted work. This applies equally to passages which are nearly the same as original publication except for minor changes. Nevertheless, copying of especially significant statements is acceptable if they are clearly identified by quotation marks, and acknowledgements are given. The following examples illustrate this point:

McGown et al. (1978) state that “There exists a fundamental unifying model for the behavior of all materials acting as tensile strain inclusions in soils”.

James and Lupton (1978) concluded that “..... it is possible to estimate quantitatively the like consequence to a hydraulic structure of having gypsum in its foundations”.

10.8 Equations and mathematical symbols

Most word processor packages have a full range of mathematical symbols. However, there are some common faults:

Typing subscripts and indices on the same line as the symbol to which they refer, e.g. $q_{ult} = c_u N_c$.
Not lining up the “equals” sign with the division bar in an equation, e.g.

$$q_{safe} = \frac{c_u N_c}{F} \quad \text{instead of} \quad q_{safe} = c_u N_c / F$$

Examiners become unsympathetic if they are made to guess what the candidate meant to insert. *All important equations should be numbered.*

10.9 Common mistakes

Apart from technical errors or excessively superficial treatment, the commonest causes of rejection of Bound Reports are:

Generally careless preparation

An excessive number of errors, due to inadequate checking.

Poorly listed references; references missing from the list.

References, Figures or Plates included, but not directly referred to in the text.

Copying without acknowledgement.

Marked similarity of large sections of the work to some published book or paper.