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Research Proposal

Division for Postgraduate Studies (DPGS)

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to action through knowledge



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Research is.....

-a systematic investigation or study of materials and sources in order to establish facts or reach new conclusions and find answers to a problem. It is normally born out of a problem.
-a process of developing new scientific tools, concepts and theories.
-a process of asking a question, or a series of related questions, and then initiating a systematic procedure to obtain valid answers to that question.



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Sources of Research Ideas

- Everyday life
- Practical issues
- Past research
- Theory
- Research often generates more questions
- Disagreements among studies can lead to worthwhile research



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Research proposal is.....

-a plan of action which spells out the research actions that you will take and this includes: context/background/purpose/rationale problem statement/research question
-a map of your thesis project: what we know about the topic, what we want to achieve and how we will achieve it (methods/interpretation)



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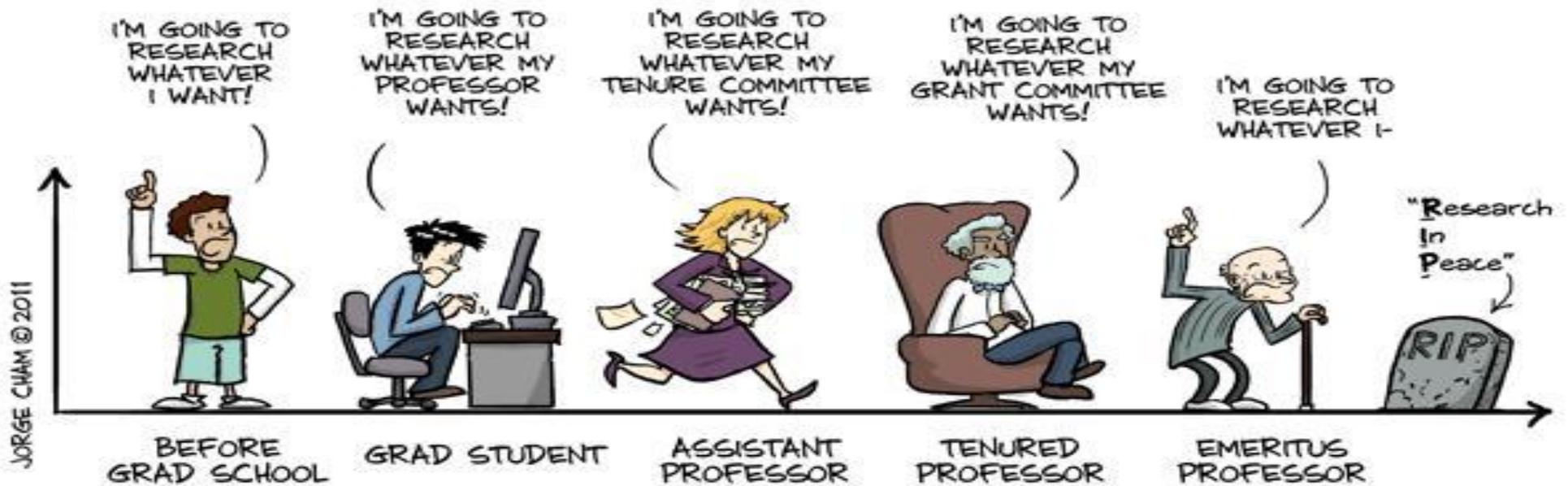
Why do we need a research proposal?

- to communicate your ideas to others
- to clarify your thoughts
- a contractual agreement
- will help you to write your thesis in a focused and disciplined way
- to adhere to scientific standards
 - Rigour (methodological)
 - Relevance (conceptual)



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Proposal Format



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- Cover Page
- Table of Contents
- Title
- Keywords
- Introduction
- Background and Rationale
- Problem statement
- Aims
- Objective
- Theoretical Framework / Literature Review
- Methodology Design and Instruments
- Expected Data Analysis
- Proposed Timeline/Time frame
- Expected Impact of the Study
- References



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Title is....

... without doubt the part of a paper that is read the most, and it is usually read first. It summarizes the main idea or ideas of your study. The title should be short, sharp, and describe what your research is about. A good title contains the fewest possible words needed to adequately describe the contents and/or purpose of your research paper. The following parameters can be used to help you formulate a suitable research paper title:

- The purpose of the research
- The narrative tone of the paper [typically defined by the type of the research]
- The methods used

The initial aim of a title is to capture the reader's attention and to draw attention to the research problem being investigated.



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Example:

The Design of Ultrasensitive Immunosensors Based on a New Multi-Signal Amplification Gold Nanoparticles-dotted 4-Nitrophenylazo Functionalised Graphene Sensing Platform for the Determination of Deoxynivalenol.



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Keywords are.....

..used to reveal the internal structure of an author's reasoning.

Example:

- Deoxynivalenol mycotoxin;
- Graphene;
- immunosensor;
- Graphene Oxide;
- Nafion



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Abstract is.....

...a brief statement that describes a larger research article, thesis, review, or conference proceeding and is often used to help the reader to quickly ascertain the purpose of the research. Components vary according to discipline:

- An abstract of a social science or scientific work may contain the scope, purpose, results, and contents of the work.
- An abstract of a humanities work may contain the thesis, background, and conclusion of the larger work.

An abstract is not a review, nor does it evaluate the work being abstracted. While it contains key words found in the larger work, the abstract is an original document rather than an excerpted passage.



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Research questions:

- What is known?
- What is Missing?
- Main question: how to look for the missing part?
- Your methods: What will you do to solve the question
- Conclusion: Why is it worth a study?

Note : Abstract Must Be Brief, Clear and Informative



Example:

Charge transfer reactions of electroactive reagents in pure Nafion film are generally slow due to Nafion's compact nature and the poor diffusion of ionic species within the film. Cationic reagents, such as tris (bipyridine) ruthenium (II) ($[\text{Ru}(\text{bpy})_3]^{2+}$), migrate into the electro-inactive hydrophobic region of the ionomer causing a loss in the electrochemical contact of the cationic material with the electrode. A highly dispersive gold nanoparticle (AuNp) dotted 4-nitrophenylazo (PhNO_2) functionalised graphene (G) nanocomposite ($\text{AuNp}/\text{G}/\text{PhNO}_2$) has been prepared and incorporated into Nafion on a glassy carbon (GC) electrode surface, in order to improve the electroactivity of the cationic reactant within the Nafion film. The Nafion nanocomposite-modified electrode efficiently loaded large amount of $[\text{Ru}(\text{bpy})_3]^{2+}$ cationic redox probe. The sensitivity of the functionalised Nafion electrode was determined by the rate at which the Ru^{2+} sites were regenerated within the film. In comparison to pure Nafion film, the $\text{AuNp}/\text{G}/\text{PhNO}_2/\text{Nafion}$ nanocomposite film exhibited 100% relative electroactivity, 30% increase in peak currents and 34.9% reduction in charge transfer resistance.



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Introduction....

-is a brief prelude or background information on the aspects involved, motivation, specific objectives and the outline adopted in a research.
-is an overview/outline of the problem – what is the key issue?
-gives reasons for undertaking the particular study-explain why the research is worth investigating.
-identifies the research problem/gap in knowledge or information/research question
-describes the nature and relevance of study
-sets your ideas into a theoretical/academic context
-indicates what the research hopes to achieve.



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Background and Rationale

The Background is a review of relevant research in the field of interest that others have done before your thesis project while The Rationale is an explanation of why you are doing this project.

- Primary sources
- What others have studied in this area?
- Why the research important ?
- What are the specific question?
- How will this add to the current knowledge?



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Problem statement is.....

-a description of a difficulty or lack that needs to be solved or at least researched to see whether a solution can be found. It can also be described as either a gap between the real and the desired or a contradiction between principle and practice.

- a brief piece of writing that usually comes at the beginning of a report or proposal to explain the problem or issue the document is addressing to the reader. In general, a problem statement will:
 - ❖ outline the basic facts of the problem,
 - ❖ explain why the problem matters, and
 - ❖ pinpoint a solution as quickly and directly as possible.



Example:

- Because of concerns with the increasing toxic effects of Deoxynivalenol mycotoxin (DON) on livestock and humans, Food & Drug Administration (FDA) has instituted advisory levels for human consumption and for cattle feed.
- There is need to design a sensor to monitor these agricultural products against DON before and after harvest (i.e. during storage) in order to control contamination outbreaks and to ensure regulatory compliance.
- Majority of the analytical methods reported for the determination of DON allow good accuracy of quantification and good detection limits but they are not cost effective; some suffer from low selectivity and usually require significant amount of time associated with labour-intensive cleanup, sophisticated instrumentation, skilled operators or technical expertise.
- In view of these analytical challenges, it is hoped that the AuNp/G/PhNO₂ composite developed in this study will provide a promising sensor platform for the construction of easy to use, rapid, cost effective and enhanced signal immunosensors for the detection and determination of DON levels in cereal food items via impedimetric system.



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Aim is.....

-an intention or aspiration; what you hope to achieve.
-a statement of intent, written in broad terms.
-a statement that sets out what you hope to achieve at the end of the project



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Example of “Aim”:

- The aim of this research is to improve the electrochemical behaviour of cationic reactants in Nafion film, consequently enhance its application in designing reproducible and ultra-sensitive immunosensors.
- Secondly, to develop a multi-signal amplification sensor platform based on gold nanoparticles-dotted 4-nitrophenylazo functionalised graphene (AuNp/G/PhNO₂) nanocomposite by applying Nafion 117 as a binder and incorporate [Ru(bpy)₃]²⁺ as a cationic reactant and/or luminescent metal centre on glassy carbon electrode (GCE).
- And thirdly, to introduce for the first time, the use of the developed sensor platform in the design of cost effective, easy-to-use, rapid and ultrasensitive immunosensors for the detection and determination of DON via impedimetric system.

Objective is.....



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-a list of specific tasks needed to accomplish in order to achieve the aim of the project.
-precise steps you will take to achieve the desired outcome
-explicit statements that defines measurable outcomes

Things to consider when drafting objectives:

Achievable – Don't attempt too much – a less ambitious but completed objective is better than an over-ambitious one that you cannot possible achieve.

Realistic – do you have the necessary resources to achieve the objective – time, money, skills, etc.

Time constraint – determine when each stage needs to be completed. Is there time in your schedule to allow for unexpected delays.



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Aims and Objectives should:

- be concise and brief.
- be interrelated; the aim is what you want to achieve, and the objective describes how you are going to achieve that aim.
- be realistic about what you can accomplish in the duration of the project and the other commitments you have.

Aims and Objectives should not:

- be too vague, ambitious or broad in scope.
- just repeat each other in different terms.
- just be a list of things related to your research topic.
- contradict your methods - i.e. they should not imply methodological goals or standards of measurement, proof or generalised findings that the methods cannot sustain.



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Example of “Objective”:

- Chemical synthesis of graphene oxide through a modified Hummer’s method using natural graphite powder as the starting materials.
- Chemical synthesis of 4-Nitrophenyl diazonium tetrafluoroborate and highly dispersive 4-nitrophenylazo functionalised graphene (G/PhNO₂).
- Chemical synthesis of gold nanoparticles dotted 4-nitrophenylazo functionalised graphene (AuNp/G/PhNO₂).
- Physical and electrochemical characterizations of the synthesised products using UV-Visible spectroscopy, Raman spectroscopy, atomic force microscopy (AFM), and cyclic voltammetry (CV) .
- Preparation of a nanocomposite thin film of Nafion/[Ru(bpy)₃]²⁺/AuNp/G/PhNO₂ onto GCE in which [Ru(bpy)₃]²⁺ serves as a cationic reactant.
- Electrochemical characterization of the thin film sensor platforms via CV, OSW, chronocoulometry, chronoamperometry and EIS systems.
- Develop an inhibition based ultrasensitive immunosensors using Nafion/[Ru(bpy)₃]²⁺/G/PhNO₂ and Nafion/[Ru(bpy)₃]²⁺/AuNp/G/PhNO₂ thin film sensor platforms on GCE for the detection and determination of DON mycotoxin levels in standard solutions via impedimetric system.
- Apply the newly developed immunosensors by analyzing extracted wheat, corn and roasted coffee.



Theoretical framework/Literature review is.....

-a text of a scholarly paper, which includes current knowledge and substantive findings, as well as theoretical and methodological contributions to a particular topic.
-a description of the existing or established theory and research in your topic area.
-proposes something that goes against or is controversial to existing ideas.
-describes how your proposal adds to previous work
-describes how unique is your proposal compared to previous work
-indicates how your study will avoid errors and mistakes that previous studies have experienced



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Research Methodology and Instruments

Research Methodology: Detailed description of the practices or technique used by the researcher to work through each proposed idea and arrive at the best solution. Research methodology refers to the development of a system or method for a unique situation. Research methodology also employs basic research techniques, such as analysis and testing.

Research Instruments: is the generic term that researchers use as a measurement device (survey, questionnaire, test, scale, rating etc.) to measure the variable(s), characteristic(s), information(s) of interest, often a scientific, behavioural or psychological characteristic. To help distinguish between instrument and instrumentation, consider that the instrument is the device and instrumentation is the course of action (the process of developing, testing, and using the device).



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Example of research methodology:

Infrastructure

In order to do tuberculosis research a specialised laboratory is needed. All experimental procedures will be performed in a Biocontainment level 3 (BCL-3) facility.

Breeding and care

The following mouse strains will be used in this study:(1) TNF floxed mice ,(2) macrophage and neutrophil specific TNF deficient mice ,(3) CD4+ and CD8+ T cell specific TNF deficient mice ,(4) macrophage, neutrophil, CD4+ and CD8+ T cell specific TNF deficient mice ,and (5) TNF deficient mice . The Animal Ethics Committee of the University of Cape Town approved all experiments.

Aerosol inhalation infection procedure

A Glas-Col inhalation Exposure System (Model A4224, Glas-Col, Terre Haute, IN) housed in a Biocontainment level 3 facility (BCL-3) was used to infect animals. Prior to use the aerosol exposure chamber was sterilised first with 4% ParaSafe (Antec International-A DuPont Company, Suffolk, CO10 2XD, England) and then twice with 70% ethanol. All accessories of the aerosol inhalation



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Proposed timeline/Time frame

- time frame - plan of the work
- length of time required to complete project
- be realistic



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Expected Impact of the Study

Example:

Deoxynivalenol (DON) is an important toxin of cereal foods and constitutes an increasing problem in several countries because the occurrence of the fungi species that produce it is very high in nature. Majority of the analytical methods reported for the determination of DON involve PCR, GC, GC-MS, HPLC, thin-layer chromatography and enzyme-linked immunosorbent assay (ELISA). These methods allow good accuracy of quantification and good detection limits but they are not cost effective; some suffer from low selectivity and usually require significant amount of time associated with labour-intensive cleanup, sophisticated instrumentation, skilled operators or technical expertise. In view of these analytical challenges, the gold nanoparticles-dotted 4-nitrophenylazo functionalised graphene (AuNp/G/PhNO₂) composite developed in this study will provide a promising sensor platform for the construction of easy to use, rapid, cost effective and enhanced signal immunosensors for the detection and determination of DON levels in cereal food items in South Africa via impedimetric system.



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References

- You must accurately reference all sources mentioned in the reference list.
- Demonstrates the depth of your research
- Acknowledges your sources of information



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Research Process

Steps to effectively carry out the research question:

- formulate the research question
- do extensive literature review
- develop the hypothesis
- prepare research design
- determine sample design
- collecting data
- execution of the project
- analysis of data
- hypothesis testing
- Interpretation
- Report

Tips



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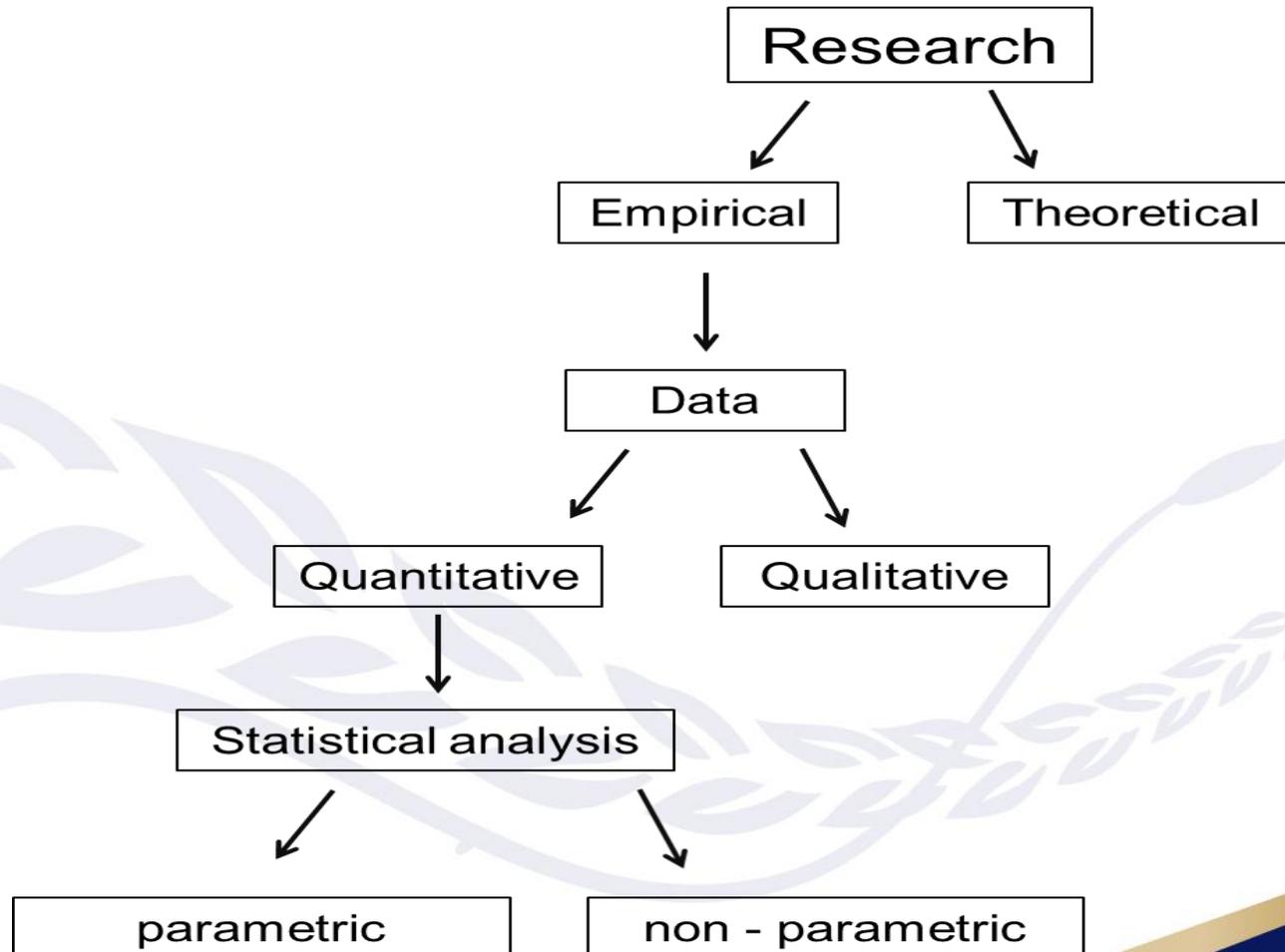
- **Research Questions:** What exactly are you trying to find out? Focus on the 'exactly' as this can lead you either into the quantitative or qualitative direction.
- **Are we interested in making standardized and systematic comparisons or do we really want to study this phenomenon or situation in detail?**
- **The Literature:** How have other researchers dealt with this topic? To what extent do you wish to align your own research with standard approaches to the topic?
- **Practical Considerations:** Issues of time, money, availability of samples and data, familiarity with the subject under study, access to situations, gaining co-operation.
- **Knowledge payoff:** Will we learn more about this topic using quantitative or qualitative approaches? Which approach will produce more useful knowledge? Which will do more good?
- **Style:** Some people prefer one to the other. This may involve paradigm and philosophical issues or different images about what a good piece of research looks like.

Types of Research design



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- Theoretical or Conceptual research-developing a theory to explain specific phenomena or behaviours.
- Empirical research-tests the predictions of conceptual research by focusing on real people and real situations.



Quantitative Research



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- Quantitative research tests well-specified, hypotheses concerning pre-determined variables; deductive.
- Sampling is random and therefore representative; findings may be generalized.
- Information is gathered in numeric form, using valid and reliable instruments.
- Findings are produced using statistical procedures and other means of quantification; usually published as articles in professional journals

Qualitative research



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- There are over 50 approaches to qualitative research from numerous disciplines; inductive.
- Designs rely on participant observation, case studies and the focused interview.
- Sampling is non-random; subjects are recruited; studies cannot be replicated; findings cannot be generalized.
- The researcher - the instrument of data collection.
- Data is non-numerical –field notes, audio tapes. video tapes, photographs, documents/reports.



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Scope and Constraints/Limitations

Some limits may need to be placed on the project, or you may not be able to conduct some research due to constraints imposed by time, cost or availability of materials.

Examples:

1) The literature survey will be as thorough as possible and will be complete by the time the dissertation is written up in full. However, one key area will require a number of visits to the British Library as some materials are not available on inter-library loan. This section will be researched over the summer break as time permits.

2) Whilst it is hoped to conduct some primary research in the USA during the summer of 2010, current restrictions on visa applications is causing some concern. Should the USA research prove impossible to achieve, secondary research will be extended in order to provide an alternative means of analysis.

Ethical Consideration



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Animal research is governed by the Animal Protection Act No 71 of 1962 as stated in the Constitution of South Africa. Operational procedures which involves animals at the University of Cape Town are performed according to specifications stated in the “Guidelines of Ethics in Medical Research” published by the South African Medical Research Council. All animal experimentation is strictly reviewed by the Animal Ethics Committee of the University of Cape Town, Project number 23/2004.

- human or animal ethical approval
- interviews, focus groups and observation
- human interaction
- ethical approval from an institutional review board
- informed consent
- confidentiality and anonymity.

Outline of sections/chapters



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Give an outline of the structure of your dissertation. Example of outline for the main body:

- Introduction
- Literature survey
- Methodology
- Results (if appropriate)
- Discussion
- Conclusions
- References



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Dissemination

The findings of this research project is novel and at least two manuscripts of international standard will be generated. Data will also be presented at local and international forums.

- professional academic journals
- conferences
- seminars and other meetings of scientific interest