

Research Questions, Aims and Objectives

by

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Scope of my presentation

- Introducing myself in a few slides to appreciate my experience in academia and research. As a UG graduate like me , your degree is recognised globally, do follow my foot steps like other UG graduates
- Introducing PhD training with a focus on your research proposals via research questions, aim and specific objectives
- Presenting three typical examples in tackling a research proposal via research questions and objectives
- Questions and answers based on typical common errors (from my experience over the years as a supervisor), guidelines, steps/time course, and the 3 examples: The good, the bad and ugly of supervisor/PhD student relationship

Introduction- Elements of PhD training

- A PhD is an original and novel piece of research work to extend the limits of what is currently known or to discover the unknown through innovative and high – quality research.
- The capacity is to ask research questions on an idea (proposal). You devise, design and conduct the research that can carry academic weight and appreciate by your peers in the form of publications in high quality impact journals
- The whole process must be honest and must also carry a strong element of integrity.
- Scientific fraud is a problem globally- very embarrassing for all involved

Proforma of Professor Jaipaul Singh

- Guyanese by birth- Uitvlugt and La Jalousie, WCD
- UG Graduate- BSc (1971); Dip Ed (1972). Left in 1974 for UK
- PhD (1978) St Andrews – Physiology and Pharmacology
- Research Fellow - St Andrews (1978-180), Dundee (1980-1981), Liverpool (1981-1984)
- UCLan (1984 -2019)
- DSc (2011) UCLAN- life time highest research degree in academia (230 research papers)
- 54 years in academia and Internationally known
- Honoured by the Guyana High Commission in London in 2011 as an Outstanding Guyanese in the UK, like David Lammy, MP, Prof Cynthia Pine, Lord Ali, Baroness Valerie Amos, Prof David Dabydeen and others

Relationship with UG

- A UG Graduate (6 years) BSc (1971) and Dip Ed (1972)
- Helped to establish MBBS course in 1987 and BDS later
- Acquiring British Council Reciprocal Grants (Appx £400,000) between UG and GPHC and UCLan for 6 years to train UG staff and doctors at UCLan and RPH (1997-2003). Gift of CT Scanner and 120 computers to GPHC, Joint World Bank Grant in 2017 for breast cancer research
- External examiner for MBBS and BDS for about 10 years.
- Candidate for VC at UG job in 2012 and 2019
- Supervised successfully 3 UG staff for MRes and PhD
- Presented graduation lecture at UG/ MBBS accreditation
- Hosted 3 UG VCs (Professors Denis Craig, Harold Lutchman and Jacob Opadeyi) at UCLan. Also Dr Bharrat Jagdeo (former President of Guyana) when he came for his DSc in Climate Change

Research Career

- Managed own research and several international links/ Budgets
- Helped to establish and manage our Graduate Research School leading to -MSc, MPhil, MD, PhD awards in 1990's
- Involved with quality assurance and course review at both School and University Levels (Urgent for UG)
- Research Director Tutor (RDT) for 16 years looking over 150 Research Students annually in two Schools from admission to awards
- Supervised 75 research students (55 PhD, 3 MPhil, 2 MD, 15 MRes)
- Examined 125 Research students for MRes, MPhil, MD and including 100 PhDs
- Published over 260 full research papers and reviews, 500 referee abstracts and attended 400 national and international meetings
- Collaborated with 8 international Universities and several hospital
- DSc award was based on my research

Time course of PhD training in UK

- **Initially:** Research proposal including research questions, working hypothesis, main aim and specific aims or objectives, a thorough literature search or background of the study (**Introduction of Thesis- 50-60 pages**): **Chap 1**.
- **Materials and Methodology** with statistics, data analysis, ethics (**Chapter 2**).
- Several different experiments to tackle scientific problems/research proposal to achieve each objective.
- We normally have at least one objective for each series of experiments or each result chapter or research question(s)
- Presenting results as a big chapter or several small chapters/or as a scientific paper (**Chapter 3 or chapters 3-7**)
- General discussion (**Chapter 4 or 8**), conclusion, scope for future studies, references, Appendices, presentation and publications
- Research students must lead the research- literature and experiments
- Many training courses through out the programme (**Compulsory**) to support PhD training
- Most UK PhDs are 3 years or 4 years (MRes + PhD)

Steps in developing research questions

1. Choose an interesting/ general topic. Most professional researchers focus on topics they are genuinely interested in studying/pursuing for target degree (PhD).
2. Do some preliminary research (Google it) on your general topic of choice.
3. Topic has to be new and novel worthy of publications and enhancing knowledge in the area. PhD should not be repetitive
4. Consider your audience if it is a publication.
5. Start asking questions: How and Why?. ...
6. Evaluate your questions. ...
7. Begin your research.
8. See my examples later

How to Write a Research Question

- A research question is the question around which you focus your research. It should be:
- **Clear:** it provides enough specifics that the audience can easily understand its purpose without needing additional explanation (**later**).
- **Focused:** it is narrow enough that it can be answered thoroughly in the space the writing/research task allows for.
- **Concise:** it is expressed in the fewest possible words (appx 80,000 to 90,000 words).
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Research questions - General information

- Different students enter the PhD program with different backgrounds either with and without research experience.
- Some did research-oriented modules (courses in USA) at undergraduate level (BSc (Hons) research project). Some did a research masters/MPhil before doing a PhD.
- Research questions addressed in a PhD programme are very new and require a long period of deeper investigation/literature review.
- Therefore, it is important to know how to find a good question that gets you excited regarding your research proposal. This is called **student-initiated research**.
- Some supervisors already have a research proposal for you and which may be relevant and also with funding
- Research questions depend on initial experience via BSc (Honours project, MREs or publications
- Experienced supervisors are open for change with discussion helping you to benefit from their experience to polish up your research questions and the methods you want in addressing for your PhD.

Research questions leading to research proposal

- You should ask a question about an issue that you are genuinely curious and/or passionate about for your PhD.
- The question you ask should also be developed for the discipline you are studying-arts, science, medicine, technology, business etc.
- A question appropriate for Biology, is different from an appropriate one in Political Science or Sociology.
- Best to discuss your ideas for a research question with your professor/main supervisor or director of study (DOS).
- **A research question is essential to the research process** by helping you to focus on your research by providing a path through the research and writing process.
- The specificity of a well-developed research question helps you to avoid the “all-about” (out of tangent) approach and work toward supporting a specific and arguable thesis (**Critical General Discussion**).

Research questions documented in laboratory book

- Best is to develop the habit of keeping things in a well-sorted student's personal file or and structure/lab note book/computer
- Open a folder for each mini project. Have sub-folders for data, reports, codes, papers you read/literature review (in computer), designs, certificates, poster and power point presentations, annual progression, and other resources. This is going to save time when you write a paper at some point in your PhD career or helping you to get a job.

Research Aims

- The term research aim usually refers to **the main goal or overarching purpose of a research project**. Sentences stating the aim of a project are usually quite brief and to the point. **Tips on how to write a research aim**
 1. Explicitly state the aim and objectives of your research. ...
 2. Determine the number of aims that should be in your proposal. ...
 3. Write them with broad terms.
 4. Make it Short. ...
 5. Conclusion.
 - An example is:
 - **Aim:** To investigate factors associated with partner violence or diabetes-induced cardiomyopathy or heart failure.
- 1. Aims come naturally once you have a research topic/proposal in mind

Specific Research Objectives

- A research aim follows by a series of statements describing the objectives of the research project.
- Research objectives indicate in more detail the specific research topics or issues the project plans to investigate (different experimentations), building on the main theme stated in the research aim (see later in examples).
- Normally 5-6 or more research objectives will be stated.
- It is good practice to put these in a numbered list so they can be clearly identified later in a proposal or report. Here is an example of a set of research objectives:
 - 1. To examine whether alcohol consumption is associated with increased partner violence.
 - 2: To examine whether labour force status (employment, unemployment, not in the labour force) is associated with variations in the incidence of partner violence.
 - 3: To explore differences between couples with an extended history of partner violence and couples with only a brief, recent history of partner violence.

Research questions, aims and Objectives

- Real Life Research done in our Laboratories
- Here are some examples of research questions, aims and specific objective to achieve over the duration of the research in the following examples of research proposal for PhD

A Typical Research Proposal/Question/ Objectives

- Is chronic myeloid leukaemia (CML) a cancerous disease infiltrating hematopoietic bone stem cells and blood platelets in our body?
- Can we treat this type of blood cancer with Imatinib, a major commercial anti-cancer drug which inhibits the enzyme tyrosine kinase?
- What would be our control(s) compared to drug treatment?
- Can we use hematopoietic bone stem cells and blood platelets from healthy control, and cancer patients before the start of Imatinib treatment and after treatments for 6 months
- How does Imatinib exert its anti-cancer effect?
- **What is the working hypothesis?** Angiogenic-, apoptotic- and autophagic levels are decreased in platelets of chronic myeloid leukaemia patients after six months of treatment with the anti cancer drug, Imatinib.
- **What is the main aim?** The main aim of this study was to determine the angiogenic-, apoptotic- and autophagic profiles of chronic myeloid leukaemia in patients *ex vivo* on platelets before and after treatment with Imatinib compared to healthy control subjects.

A typical research proposal/Question/ Objectives

- What are the specific objectives based on the experimentations?
- This study carries several scientific techniques including microscopy of the platelets for their morphology, flow cytometry, apoptosis, caspase 3 activity and autophagy (or cell death), angiogenic markers, TGF-beta and Western blotting using established scientific techniques in tackling the problems either before or after treatment.
- **Specific objectives (based on the different techniques and literature search)**
- 1.To undertake a thorough literature around the subject area.

Specific objectives

- 2. To conduct Wright staining and subsequent visualization by light microscopy on healthy participants' blood and CML patients to determine leukocyte counts.
- .3. To determine morphological effects of controls and of CML patients at diagnosis and after treatment by utilizing electron microscopy including scanning electron microscopy and transmission electron microscopy.
- 4. To determine platelet counts, viability and activation by human cluster of differentiation 41 and 62 using flow cytometry.
- 5. To investigate the apoptotic effects by measurement of the phospholipid flip via Annexin V-fluorescein isothiocyanate (FITC) and caspase 3 measurement by flow cytometry.

Specific Objectives

- 6. To examine the autophagic profile via investigating LC3-I to LC3-II conversion through Western blotting and quantification of autophagy-related gene 5 levels using flow cytometry.
- 7. To establish the plasma angiogenic profiles by measurement of angiogenic biomarkers released from platelets.
- 8. To analyse the data statistically and write up the PhD study

Another PhD example

- Can moderate daily exercise be used beneficially to treat type 2 diabetes mellitus?
- Can daily moderate exercise help to prevent or delay diabetic–induced heart failure and sudden cardiac death?
- How does exercise help to treat type 2 diabetes and repairing the heart?
- What are the mechanisms action of daily moderate exercise?
- Is exercise beneficial to healthy individuals as well?

Hypothesis, Aim and specific objectives

- **Hypothesis:-** Regular daily exercise can be used beneficially to treat type 2 diabetes mellitus and repairing the heart
- **Main Aim:-** This study investigated the beneficial effect and mechanism of action of exercise in type 2 diabetes mellitus.
- **Specific Objectives or Aims:-**
 - 1. To undertake a thorough literature search around the subject area
 - 2. To implement or decide on the experimental animal model (control and diabetic) and to design and undertake the exercise regime over a period of 3-4 months

specific objectives

- 3. To measure blood glucose levels on a daily basis until end of experimental period
- 4. To measure the function of the heart in control and exercise states
- 5. To investigate the structure of the heart in control and exercised conditions
- 6. To measure fibrosis, hypertrophy, Apoptosis, TGF-beta 2 and gene expression for calcium proteins in the hearts of control and exercised conditions
- 7. To analyse the data and write up the PhD thesis

Another example

- Can bitter melon or corilla be used beneficially and cost-effectively to treat breast?
- What components of the vegetable possess anti cancer properties?
- What types of experimental techniques can be used to tackle the scientific problems?
- Are breast cancer cell lines good experimental models to use in this research proposal or should we use original breast cancer tissues?
- What should we use as a control model?
- Should we compared bitter melon extract with other known anti cancer drugs?
- What are the cellular mechanisms of action of cancer cell death?

Aims

- To investigate anti cancer effects of *(Momordica Charantia) corilla/bitter melon* extract and cisplatin on triple negative cancer cell line viability compared to healthy breast cancer cell line.
- To investigate the cellular and molecular mechanisms of action on cancer cell death

Specific objectives

- 1. To undertake a thorough literature search around the subject area
- 2. To prepare the alcoholic extract from corilla
- 3. To learn the technique of breast cancer cell culture
- 4. To undertake both time –course and dose dependent effects of corilla extract and cisplatin on cell death/viability
- 5. To investigate the cellular mechanisms of breast cancer cell death measuring a number of biochemical parameters
- 6. To analyse the data and write up the PhD thesis

Problems, Questions, Errors and Answers

- Project is sound and workable research project over the time.
- PhD is not a 9-5 job. It is a 24 hour job with integrity/honesty.
- Student must lead the literature search and the experimentation. Meet with supervisor very often.
- Student must have an independent research approach and not act as a technician.
- Not because you have a first class degree, then you want to act like the supervisor.
- Friendship with other staff members can be detrimental to your research approach by taking advice from them. Your supervisor knows the best for you. This can initiate conflict of interest.
- Best to appreciate what your supervisors are saying regarding research questions and objectives. They have been appointed to guide you via their previous experience.
- Students are over enthusiastic and go out of tangent
- Some students do not do their home work-reading broadly around the subject area

Problems, Questions, Errors and Answers

- Some students are unable to lead experiments
- If it a new area, then student should know more on subject area than supervisor
- Some students do not like to visit other labs to do research work.
- All students must join one or two professional societies.
- Some students prefer more writing that lab work. Good in writing and less good with hands
- Some students do not see eye to eye with supervisors: Arguments occur leading to disaster. **Constant conflict**
- Some students are merely technicians
- Some students behave as it they are the supervisors
- Some students are led astray by friends and neglect research

Problems, Questions, Errors and Answers

- It is a bit awkward to supervise some mature students who feel bigger than the supervisor
- Some students do not like to repeat the experiments several times
- Some students select only best results in presentation. Good to show some bad results as well for comparison
- There are many cases where students are neglected by a supervisor. As such student fall on way side or ask to leave the programme. This is morally wrong. Supervisor has a moral duty to see the student through for the target award.

Research Guide Lines Admissions

- Entry qualifications must be right
- Supported academic references must be proactive for admission
- Research proposal must be sound and workable (with excellent research questions, aims and objectives, methodology, costing affordability of research and completion in timely manner), appropriate supervisors and with good working relationship.
- Supporting training courses for PhD including -ethics, scientific honesty and integrity, COSHH, statistics, health and safety, literature review, writing research papers, grants , transfer report, PhD thesis, mock viva etc)
- Annual progression and personal file keeping
- Transfer report and PhD phase
- Examination appointment and Examination
- Thesis submission
- Thesis correction and final correction etc
- Please follow guide Lines as per your University

How I supervise my students?

- **Admission:** Interviewing student, adequate qualifications and bench support to run project. Student is given a topic based on techniques available in our laboratory to tackle the scientific problem. Student can come up with his or her own proposal which must fit with our resources.
- **Start:** Given bench space, table, chair and computer. Spend 2-3 weeks learning some techniques with senior students or staff.
- Take 6 weeks to undertake a thorough literature search around the subject area and at the same time write up a 50 page review in the area, possibly for publication. Student must understand the subject area thoroughly.
- Student must now complete the registration document (Mphil/PhD phases) supported by ongoing compulsory training on ethics, experimental design, literature review, writing a research paper, thesis and a grant, health and safety, statistics, poster and pp presentations and others.

How I supervise my students

- **Supervision report:** Students must meet with supervisors once each week but document meeting once per month
- **Experimental work:** Student starts with experimental work in the lab and also attends regular training courses.
- **Progression:** At end of year 1 student has meetings with supervisors and RDT for annual progression. If failed, student repeats it in September. If student fails, student is asked to exit course

How I supervise my student?

- **Year 2:** Student continues with research and with other training courses.
- By now student will submit the review and present an abstract at a meeting.
- Student must join 1 or 2 professional societies. Student may also visit a foreign lab for 3-4 months to do research.
- At end of year 2 student must write a transfer report (Mini thesis) for transfer from MPhil to PhD.
- Referees are appointed to examine student. Student must also go through progression. If problems, student is asked to write up for MPhil.

How I supervise my student?

- **Year 3:** Student continues with more focused research and starts to write up scientific papers and presenting 2-3 more abstracts.
- **Writing up Time:** Three months before end of year 3, student must write up PhD thesis with guidance from supervisors.
- **Appointing examiners:** Examiners (external and internal are appointed)
- **Submission:** Thesis is submitted. Student get 2-3 mock exams. Student is finally examined.
- Student is asked to make minor corrections to thesis and submits it to internal examiner who will recommend award. Student is awarded PhD and attends graduation.
- By now, student must publish 1 review and 4-5 original research papers.

Research Guide Lines

- Questions and Answers