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Getting started with research 'Beginning: defining a research question and preparing a research plan'

Jacinta E Browne

Medical Ultrasound Physics and Technology Group, School of Physics and FOCAS Institute, Dublin Institute of Technology, Kevin Street, Dublin 8, Ireland

Email: jacinta.browne@dit.ie

Abstract

Research is the lifeblood of medicine, with innovations being made in the different technologies used to diagnose and/or screen for the presence of disease or to deliver treatments with higher efficacy. Scientific publication is the network of vessels which delivers the lifeblood. The outputs of research provide us with tomorrow's medicine. In this series of articles we will be discussing the different aspects of carrying out research, from the conception of the research idea to publication in a peer reviewed journal, with the cycle repeating again with new research ideas emerging from the research conducted.

Keywords: research methodology, research question, literature review

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Introduction

The first question a person might ask about 'research' is 'What is research?' You will be familiar with what research is, as we are presented with research findings in media reports and clinical journals on new medical treatments. Or the consequences of research findings may affect you directly through changes in work practices, if a study into your clinical area deems it necessary. Leedy and Ormrod,¹ who are educational writers, suggest 'research' is 'a systematic process of collecting, analysing and interpreting information (data) in order to increase our understanding of the phenomenon about which we are interested or concerned'. The UK Department of Health defines research as 'a structured activity, which is intended to provide new knowledge which is generalizable (i.e. of value to others in a similar situation) and intended for wider dissemination'.² The main feature of research is that it involves a planned, systematic and repeatable approach to test a theory or hypothesis, or to further our understanding of a topic, either through physical or theoretical models. We will explore this further in the next section dealing with the research process.

The second question a person might ask regarding 'research' is 'Why do research?' For most people, the motivation to carry out research may be due to the requirements of an academic qualification being pursued, such as a Master's degree, or a PhD degree, while for others, carrying out research is part of their work and the PhD is just the beginning.³

Overview of the process of identifying a suitable research question and plan

The following is an overview of the research process, which outlines the typical steps taken while carrying out research and which should be considered in terms of your research time plan.

Developing a research idea – define the question, form the hypothesis

Choosing your research topic is probably one of the most important decisions you will have to make while carrying out your research. Making a good decision here is what will keep you motivated throughout the project and help you to keep motivated to see the project to completion. It may be that you are proposing your own project topic for an area that is of particular interest to you, or if you are being employed while carrying out your research, there may be a piece of research that needs to be conducted, that will influence work practices within your department. On the other hand, it may be that you have identified a research group, where you plan to carry out your research project, or that you have obtained a scholarship to work on a particular topic. Regardless of the way in which you have chosen your research topic, you will need to become knowledgeable in that research area, in order to define how your research idea fits with current knowledge. This is achieved through background reading and literature searches, which are critical to identifying the gap in the

current scientific knowledge. At this stage of the project, you are essentially gathering information and determining what resources you have available to carry out the project – literature review, defining project aims and objectives, identifying suitable experimental approaches, maybe negotiating time-off if you are carrying the research out while working, etc.

Literature review

A literature review offers an overview of the relevant and significant literature related to a research area. It should involve a review of the critical points of current knowledge on a particular topic – i.e. a survey of articles, books, conference papers, theses, etc. It allows the researcher to place each piece of work in the context of its contribution to the understanding of the research area under review. It provides an opportunity for the researcher to determine the relationship of each piece of work to the others under consideration and resolve conflicts among seemingly contradictory previous studies. But most importantly, it allows researchers to identify areas of prior scholarship, to prevent duplication of effort and points the way forward for further research. There are a number of approaches to identifying the literature pertinent to the research area under investigation. The first approach may be to use literature databases, such as PUBMED, WEB of KNOWLEDGE, CINAHL, Scopus, Science Direct and GOOGLE Scholar. These databases can be interrogated by using relevant keywords, or searching for authors known to be active in the area. The approach of using the keyword may help to identify authors who are active in the area and the database can then be interrogated using the author's name. On the other hand, if you have a good paper on the research area, you can use this to search (1) backward, by using the list of references in the paper and (2) forward, by investigating if it has been cited by other research groups. This will yield information regarding what type of research has been conducted and disseminated as a research publication around the research topic under investigation. This previous point highlights the critical importance of disseminating your research findings upon conclusion of your research project, otherwise unnecessary duplication of research will occur. Finally, key literature can be identified by regularly reading key journals for the research area and will keep you abreast of the current knowledge in the research area.

The following are some useful questions to ask while evaluating the literature and using the literature to inform your research question:

- What are the author's credentials? Are the author's arguments supported by evidence?⁴
- Is the author's perspective even-handed or prejudicial?
- Is contrary data considered or is certain pertinent information ignored to prove the author's point?
- Are the author's arguments and conclusions convincing?
- Does the work ultimately contribute in any significant way to an understanding of the subject?

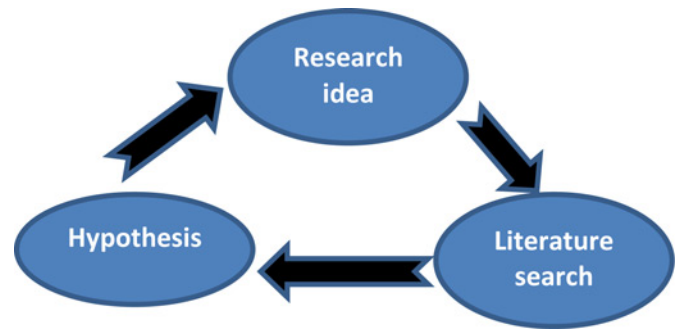


Figure 1 Flow diagram of how the research idea or question is developed

Once a thorough review of the scientific literature has been conducted, it is critically important to verify that the research question for your project is still valid (Figure 1). A pertinent question to ask yourself at this point is 'Will the work lead to an academic thesis or a publication in the scientific literature or both?' If the answer is 'Yes', then you have identified your research question. The research question or problem can then be separated into more manageable 'sub-problems' or objectives; by specifying the objectives of the project, they provide a roadmap for the project and will also help to identify suitable methodology for the project. Keep in mind that it is important to identify realistic, achievable objectives so that you can complete the project successfully. This could mean that you know the limitations of your carrying out the research namely, your own experiences/skills and how these will be developed over the course of the project, the existing equipment, facilities and the available expertise in the hospital or research laboratory where you will be conducting the research.

Developing the research plan

The next step is to develop a research plan and study design, which involves selecting the most appropriate methods, which the review of the scientific literature should have helped to identify. In order to employ these methods, what equipment should be used? This should be decided based on the efficacy of the equipment, 'Is it suitable or fit for the task?', 'Will it produce reliable and reproducible data?' Once the equipment has been identified, you will need to determine whether you have access to such equipment, and if the access to this equipment is limited, can you negotiate more access time. Or you may need to pay to use this equipment and so need to apply for funding to cover the cost. Next you will need to decide the most appropriate study population, namely what patient groups will be included in the study and is a control group required? It is often useful at this design stage of the project to seek advice from a statistician to determine the numbers of subjects necessary to reach statistical significance in the study and thus obtain meaningful results from the study. Remember to keep an eye on ethical issues such as research involving humans or animals

and obtain ethics permission well in advance. Ethics applications often require you to have carried out statistical analysis such as power calculations, to determine the number of subjects to include in the study.

In conclusion, a well-developed research question and research plan will give you a road-map for your research and help keep your research on track. It will also help to avoid issues later on with the study design, such as whether the equipment used was actually appropriate or whether the correct number of subjects were included in the study. It is critical to carry out a thorough review of the scientific literature of the research area in order to develop the research question and plan but also appropriate methodology. The next article will discuss applying for

ethics approval for your study, getting started with data collection and data management.

REFERENCES

- 1 Leedy PD, Ormrod JE. *Practical Research - Planning and Design*. 9th edn. UpperSaddle River, NJ: Pearson Education, Inc., Publishing as Merrill, 1998
- 2 http://www.dhsspsni.gov.uk/research_governance_framework.pdf (last checked 4 March 2013)
- 3 Blaxter L, Hughes C, Tight M. *How to Research*. 3rd edn. Buckingham: Open University Press. 2006, ISBN 0 335 19452 4 (pb)
- 4 http://www.casp-uk.net/wp-content/uploads/2011/11/CASP_Systematic_Review_Appraisal_Checklist_14oct10.pdf (last checked 4 March 2013)