Making research work for you: Responsibilities and pitfalls

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Abstract

A large number of postgraduates in the computing disciplines in Australia and New Zealand are full-time teaching staff in universities and colleges. The completion rate can be slow, as many face competing priorities at work and at home, so any way that student progress can be effectively improved is a bonus for the postgraduate, the institution and others around them. This paper discusses aspects of postgraduate research, such as the responsibilities and pitfalls encountered by the author during the development of his own PhD, using action research and ethnography in a longitudinal study of an online learning community. It is hoped that this paper, may help other postgraduates with their research journey, by reflecting upon ways to make research work better for them and realising the responsibilities needed in avoiding the pitfalls which delay successful completion of a thesis or professional doctorate.

Keywords

Project planning, thesis writing, literature review, research process, research methods, time management, strategic planning, part-time postgraduate academic research, balancing work and research

1. Introduction

This paper is a structured narrative of my experiences as an academic combining full time teaching with research for a PhD since 1998. Doing postgraduate research in computing and information technology fields connects amazingly to the concepts and processes of the 'things we do', namely object-oriented methods and project management.

The nature and direction of research and its components are discussed; some examples of implementing proper project management of the thesis are given, and the issue of making research work for the reader is elaborated upon. Research does not follow a single template, is a personal process and evolves with each iteration and step along the road to completion.

It is a hope that some of my documented experience and methods will be of benefit to other students and supervisors.

2. Computing Research - You are Not Far from Anywhere

Computing research is a relatively new field of research, which calls upon the research methodologies developed in other areas like social science and education. Developments in the use of information systems research methods by Professor Michael D. Myers (Myers, 2003a; 2003b) in New Zealand and Professor Ron Weber in Australia (Weber, 1999; 1994) and the Association for Information Systems at http://www.aisnet.org/, are a good starting point for examining information systems research methods. They are also useful to other areas of overlap such as information
technology, networking, computer science and software engineering projects. Working closely with your supervisor, you cut your own path through a dense forest and at times feel quite alone with out realizing that you are not far from anywhere.

3. This Goes with That...

It is vital to work out the frameworks and taxonomy of research - their classification into groups and those computing activities that are associated. The use of qualitative research methods is particularly strong in information systems research. Here is a short table (Table 1) to get started:

<table>
<thead>
<tr>
<th>Quantitative</th>
<th>Qualitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Metrics</td>
<td>Usability Testing and System Trials</td>
</tr>
<tr>
<td>System Performance</td>
<td>Interviews - Delphi and Q Methodology</td>
</tr>
<tr>
<td>Capacity Testing</td>
<td>Content and Discourse Analysis</td>
</tr>
<tr>
<td>User Surveys</td>
<td>Ethnographic Studies</td>
</tr>
<tr>
<td>Questionnaires</td>
<td>Case Study Method</td>
</tr>
</tbody>
</table>

**Table 1. Research method domains & associated instruments**

For research into professional practice, an action research model is useful, as discussed later.

4. Which Way?

A lot of research methods are said to be from the social sciences rather than the hypothesis testing of scientific methods. So now it gets very hard to decide which way to turn. In IT we can build our research methods by looking both inwards and outwards at the ‘things we do’. This is where the review of the literature is handy to move you towards focusing and developing some key questions and a problem.

5. Planning Your Dissertation

Some basic planning steps to follow were made aware to me at a thesis writing workshop (Eustace & Dunn, 1999). It is important to start by writing a list called the 'Project Data' Template(Figure 1) that:

- Identifies the core activities
- Determines their logic and sequence
- Reveals a time management plan
- Estimates the time and resources required - economies of scale
- Present your this list or plan to others: supervisors, peers

![Figure 1. Project data form as a template to shape ideas](image)

The project data form (Figure 1) is used to develop a project proposal plan to present to your supervisors and colleagues. If your study involves human participants, it is vital when planning the methodology that you conform to the ethical guidelines for that research. All dissertation proposals are screened for ethical approval prior to acceptance; although as a research thesis student you should have at least considered these issues before writing and submitting the proposal. A well considered proposal plan (Figure 2) is likely to win you praise from your supervisors. The ethical guidelines are a big help in finalising the research design, methodology, instruments used to collect the data and how it will be processed, communicated and stored.
6. Project Management and Planning of the Thesis

A research student has to undertake two crucial activities, in a 'to' and 'from' manner:

**Forward schedule**: start the activities on a given date and carry them forward to the finish date.

**Backward schedule**: look at the date when the thesis is due and work out the logic and start dates of activities backwards.

Try to reduce the amount of multi-tasking ('bad multi-tasking') in your work. Imagine you have three tasks to do at the same time:

- **A**: your literature review;
- **B**: technical assignment; and,
- **C**: essay on research methods.

Here is a short example of the impact of bad multi-tasking (Figure 3):

Assume each task took 10 days. If you do them in sequence, then the lead-time from start to finish is about 30 days. If each of these tasks was broken into 2 smaller units of work, by doing half of each before returning later to finish off each second half, then the effect of such **multi-tasking** is to make each project LONGER than they needed to be.

6.1 Interim Project Plan

The time constraints are the START and FINISH dates for each activity. This can be entered into a Microsoft Project plan or on paper using an * for each week.

Let me assume that you start on Monday 02 February, 2004 and finish on Monday 08 November. [You will learn to like "Mondays" for your project milestones]. That means that your thesis year is about 39 weeks long; for a PhD, multiply by 3 (Table 2 and Table 3).
6.2 ‘June’ Revision of the Plan

The plan is revised and running well by the start of ‘June’ (the metaphorical halfway point) and has changed shape due to the impact of the research methodology and the choice of quantitative and qualitative tools. The use of a questionnaire in my example, could readily be substituted by a range of information systems research methods, such the use of interviews, case study method, field work, ethnographic techniques etc. The revised plan is likely to reveal how a bottleneck brings back potential for 'bad multi-tasking' during 'September' (the 75% stage of the thesis). Write-up, revision and edit, as well as the submission, are kept clear and on track, as you work to the finish line with your supervisors (Table 4 and Table 5).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project start date</td>
<td>02/02 -</td>
</tr>
<tr>
<td>1 Generate potential topics</td>
<td>02/02 - 15/03</td>
</tr>
<tr>
<td>2 Carry out literature review</td>
<td>01/03 - 16/03</td>
</tr>
<tr>
<td>3 Finalise topic</td>
<td>17/05 - 24/05</td>
</tr>
<tr>
<td>4 Design study</td>
<td>17/05 - 31/05</td>
</tr>
<tr>
<td>5 Prepare materials</td>
<td>31/05 - 21/06</td>
</tr>
<tr>
<td>6 Gather data</td>
<td>21/06 - 26/07</td>
</tr>
<tr>
<td>7 Analyse data</td>
<td>02/08 - 30/08</td>
</tr>
<tr>
<td>8 Write-up</td>
<td>30/08 - 27/09</td>
</tr>
<tr>
<td>9 Review and edit</td>
<td>27/09 - 01/11</td>
</tr>
<tr>
<td>10 Submit dissertation</td>
<td>- 08/11</td>
</tr>
</tbody>
</table>

Table 2. Interim activity planning

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Potential topics</td>
<td>Feb.</td>
</tr>
<tr>
<td>2 Literature review</td>
<td>Mar.</td>
</tr>
<tr>
<td>3 Finalise topic</td>
<td>Apr.</td>
</tr>
<tr>
<td>4 Design study</td>
<td>May.</td>
</tr>
<tr>
<td>5 Prepare materials</td>
<td>Jun.</td>
</tr>
<tr>
<td>6 Gather data</td>
<td>Jul.</td>
</tr>
<tr>
<td>7 Analyse data</td>
<td>Aug.</td>
</tr>
<tr>
<td>8 Write-up</td>
<td>Sep.</td>
</tr>
<tr>
<td>9 Review and edit</td>
<td>Oct.</td>
</tr>
<tr>
<td>10 Submit dissertation</td>
<td>Nov.</td>
</tr>
</tbody>
</table>

Table 3. Interim project plan in graphical form

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project revision date</td>
<td>06/04</td>
</tr>
<tr>
<td>1 Update literature review</td>
<td>16/04</td>
</tr>
<tr>
<td>2 Arrange visits</td>
<td>30/06</td>
</tr>
<tr>
<td>3 Prepare questionnaire</td>
<td>25/07</td>
</tr>
<tr>
<td>4 Review questionnaire</td>
<td>08/08</td>
</tr>
<tr>
<td>5 Deliver questionnaire</td>
<td>25/09</td>
</tr>
<tr>
<td>6 Analyse results</td>
<td>31/08</td>
</tr>
<tr>
<td>7 Write-up</td>
<td>30/09</td>
</tr>
<tr>
<td>8 Review and edit</td>
<td>31/10</td>
</tr>
<tr>
<td>9 Submit dissertation</td>
<td>08/11</td>
</tr>
</tbody>
</table>

Table 4. Revised activity planning in 'June'

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Update literature review</td>
<td>Jun.</td>
</tr>
<tr>
<td>2 Arrange visits</td>
<td>Jul.</td>
</tr>
<tr>
<td>3 Prepare questionnaire</td>
<td>Aug.</td>
</tr>
<tr>
<td>4 Review questionnaire</td>
<td>Sep.</td>
</tr>
<tr>
<td>5 Deliver questionnaire</td>
<td>Oct.</td>
</tr>
<tr>
<td>6 Analyse results</td>
<td>Nov.</td>
</tr>
</tbody>
</table>
7. Writing a Thesis as an Object Orientated Process

Computing and information technology students are not renown for their oral and written communication skills, when compared to other fields like science and education. This section is designed to help improve the writing skills needed for a thesis. In discussing the management of the writing process, Brown (1995) provides a solid discussion point relating to the twin issues of the big picture and the big question by stressing the need for:

- continued direction;
- deliberate management using top-down methods;
- creation of clarity;
- a grammar focus;
- a hierarchy of tasks vs. questions;
- the essence of management as self-determined;
- an ability to manage time and fear;
- combining the suspense format and the journalist pyramid form of writing.

Top-down management is an approach which leads to the final breakdown of the writing process, beginning with the big question, into the basic level 6 unit called the sentence:

1. Big question
2. Subsidiary questions
3. Chapters
4. Sections
5. Paragraphs
6. Sentence

The sentences should be simple, short and sharp as simplified prose is better and is always clearly thought out. You need to begin writing the day you begin your thesis. Reading out aloud is a good way to refine your thoughts and helps to build your associative memory skills. There is often an early inertia as feelings about lacking knowledge can stop you from starting to write, so consider the following advice: "You don't know what you don't know until you start writing"

The management of the writing process should develop a feel for synchronised research and writing, so try not to separate either part of your thesis. This method is an object modelling process, where each thesis object is modelled to assist in developing cohesion. Some objects in the thesis structure for definition and linking are:

Thesis

- Acknowledgement
- Table of Contents
- Chapter
- Introduction
  - Heading level
    - Paragraph
    - Sentence
      - Footnote
      - Citation
    - Figure
  - Table
- Literature review
  - Question hierarchy
- Theoretical/practical framework
- Research design
- Methodology
  - Raw data
- Analysis of data
- Results
- Conclusion
- References
Appendix

In tabulated summary the linkages can be made vertically and horizontally in Table 6.

<table>
<thead>
<tr>
<th>Title</th>
<th>Footnote</th>
<th>Research design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgement</td>
<td>Figure (graph/diagram</td>
<td>Methodology</td>
</tr>
<tr>
<td>Table of contents</td>
<td>Table</td>
<td>Raw data</td>
</tr>
<tr>
<td>Introduction</td>
<td>Station</td>
<td>Analysis of data</td>
</tr>
<tr>
<td>Chapter</td>
<td>Literature review</td>
<td>Results</td>
</tr>
<tr>
<td>Heading level</td>
<td>Section hierarchy</td>
<td>Conclusion</td>
</tr>
<tr>
<td>Paragraph</td>
<td>Theoretical framework</td>
<td>References</td>
</tr>
<tr>
<td>Sentence</td>
<td>Practical framework</td>
<td>Appendix</td>
</tr>
</tbody>
</table>

Table 6. Defining and linking objects in the thesis structure

8. Critical Literature Review

Robertson (1999) suggests that thesis writing must provide a well structured and up-to-date review of the literature. This section examines the why? what? and how? of writing a critical literature review.

8.1 Why Do a Literature Review?

| For the project: | To find evidence and to establish the need for your project. |
| For yourself: | To continue the process of learning and research that will continue throughout your academic life. |
| For the examiners: | To establish your professional competence; To provide a theoretical framework, or a practical framework to justify a project. |

Table 7. Some reasons for doing a critical review of the literature

You are writing for the project, for yourself and for your examiner(s). For the project under investigation, a critical literature review helps to find evidence for the need for the project or investigation such as filling a major gap in knowledge. Since the literature review is a continuous process, it does require a disciplined organization and helps the writer to track resources and to read critically, discover methodologies and to build a research design. Finally, the examiner looks for your professional competence in the topic area in both depth and breadth. It is important to use the literature review to build the theoretical and practical frameworks or context for the study. The examiner has to be convinced that the project is justified (Table 7).

8.2 What’s in a Literature Review?

One way of answering this is to describe a literature review as having five features:

- Breadth
- Shape
- Logical flow
- Detail - General
- Primary literature

Sometimes a gap appears in the literature. That gap may contain your research agenda and point you in the right direction, so do not ignore the worth of the literature review. The researcher’s 'hour-glass' model (Figure 4.) is useful in helping to see the process and functions, together with its connections to other stages in the development of your thesis, that the review of the literature helps to reveal.
Figure 4. The hourglass model for shaping the research process

Overall the literature review has an hour-glass shape. At the top it begins with broad context literature that shows where the research fits into the industry, discipline on environmental context. Then it narrows or spirals down to primary literature relevant to the problem itself. This stage also exposes knowledge deficiencies and justifies your research. At this stage you must exhibit a grasp of the significant literature and knowledge gaps which your thesis will address.

Your research project takes place at the narrow waist of the hour-glass after which the story 'widens out' again showing the results, interpretation, discussion and conclusion. At this stage you should return to the 'big' question. Keep the literature review short and show only major and significant references. Fifty pages of references are too much!

Start with the broad literature on your topic - there is no need for primary critical literature - but you get down to your 'big question' about a specific topic. Then you need to go on to the seminal and primary literature to establish the knowledge gaps, where you will work. Learn to work the gaps.

8.3 What is Primary Literature?

This is often asked and the immediate answer that is often used includes peer reviewed articles, however the theses of other students before you, are also quite valuable.

8.4 What Does the Literature Do?

It describes, summarizes, evaluates, clarifies, integrates, synthesizes, informs and targets - i.e. takes the reader somewhere on their thesis journey. Be aware that the literature does not list, regurgitate, confuse or ramble.

8.5 How Does I Do All This?

Sources include your supervisors, library, Internet (Web sites, chat groups (e-mail, newsgroups and Web bulletin boards), experts, conferences and workshops (like the one that spawned this paper!). At this stage, you must realize that the supervisors are reaching their 'used-by dates', because in most fields, the literature is so vast, for example, agriculture or the agenda is volatile and changing rapidly e.g. information technology research. The supervisor's most useful role is in quality control - for example, to help you to throw away a lot of irrelevant literature and to introduce you to the experts in the field. A good idea is to take your supervisor to conferences so that they can introduce you to the experts, or you should try to find and participate with an e-mail discussion group to filter your references and to develop your methods.

8.6 The Literature Review Chapter

This must have:

- a beginning - broad scope
- a middle - details
- an end - conclusion
Use a check list containing when proof reading is done by you and by others:

- focus - is it clear?
- goals
- perspective - is a new reader able to follow?
- coverage - detail
- organization - is it clear and logically presented?

8.7 Focus

Make a list of goals and write a topic or mission for your literature review. This will help develop coherence and a sense of where your work is heading.

The writing process may be structured. The list below shows one way this can be done.

- Make piles/lists of articles you have read - these will be your sub sections;
- Draw a map or diagram of the relationship between all sub sections - this provides the logical flow;
- Summarize main points arising from each sub section - these are headings within sub sections;
- List the major points form each paper, go back and re-read the articles and note the main points - these are the issues;
- Obtain feedback from your supervisor at this stage, to make sure you are on the right track.

9. Common Problems and Pitfalls

A search of Web sites from Australian universities which offer an honours thesis program in information technology, revealed some common problems and pitfalls in the research process, for students working in computing and information systems research areas.

- the thesis topic is too broad
- the student tries to combine full-time work with research
- the student does not maintain the agreed work schedule and therefore submits large quantities of marginal quality work late
- the student exhibits poor English expression, writing style and spelling
- the student expects the supervisor to do the work
- the student experiences difficulties which are not addressed early enough.

10. Professional Perspectives

Organisations like New Zealand's National Advisory Committee on Computing Qualifications (NACCQ) and the Australian Computer Society (ACS) desire those who are involved in teaching computing courses to stress that the information and communications technology (ICT) profession is a 'people-oriented' profession, not just 'technically-oriented'.

11. What's My Job?

In trying to determine the tasks of research, a checklist is handy for both students and supervisors, in helping to identify a topic or area of interest, as well as the responsibilities.

- finding a supervisor to supervise my work in the chosen area
- preparing a thesis proposal
- reporting on my progress as required
- maintaining my progress as per thesis proposal and project plan
- negotiating alterations to the thesis proposal and project plan with the supervisor
- meeting regularly with my supervisor(s) to discuss progress
- ensuring that language, writing style and presentation of submitted work satisfies the institution's requirements.

12. How Do You Find Time to Do Research?
Revise the priorities in your time management plan to eliminate the 'time bandits' in your life. I started to work on research on weekends, but I knew that was not enough. The university or college may have some time release plans such as marking assistance or study leave, - so asked. In my case, I took some funding for time release from marking and some research (but the money ran out). Then a special committee gave me some study leave. However you find the extra time to do your research, the return on investment (ROI) for the institution and your professional development is very sound. Professor Frank Vanclay once told me: ‘be prepared to invest in your own research as the return on your investment is very good’.

13. Working Smarter by Blurring the Boundaries

I knew I had to devise 'working smarter' strategies, methods and efficiencies in order to help make research 'work for me'. Here are some ideas I had.

13.1 Smart 1: Fuzzy Research

The first idea I had was not original but powerful. It was make my teaching my research and vice versa. I made the boundaries fuzzy and called it a learning journey. NACCQ, ACS and other organizations (for example, Australasian Society for Computers in Learning in Tertiary Education- ASCILITE) flourish by riding and nurturing the wave of research into the professional practice of the ICT profession. In my case, that fuzzy approach was through the use of ICT in education (Eustace, 1998). So take your research domain such as networking, e-commerce, spatial information technology or computer ethics and security and connect it closely to your own professional practice, now and in the future. You can start to blur the edges of your teaching and research by looking at the way research is done in other professions. In education and health, for example, much research is targeted at moving the profession forward, by use of the action research method, where you examine your own professional practice.

13.2 Smart 2: Action R

Action researching your own professional practice as a lecturer, brings together the Gemini twins of teaching and research. One useful action research approach is to take a learning journey and take a closer look at yourself by starting to plan, act, observe, reflect, on your own practice, as both teacher and researcher.

13.3 Action Research as a Scaffold

Plan, act, observe, reflect are the main stages in each cycle of the action research iteration. The action research approach I used is based on the 'Deakin' model, supported by Kemmis & McTaggart (1990) and illustrated in Figure 5:
13.4 Hybrid Methods - Is That Smarter?

The use of multiple methods, such as action research and ethnography (with interviews, focus groups, content and discourse analysis), is a form of triangulation of research methods, which:

- maximises the validity of results,
- allows for replication of results in different problem domains.

Replication then provides:

- generalisation and reliability for your results.

13.5 Analysis of Results

All artefacts are examined in a manner consistent with the Deakin action research model. Action research includes self-reflective enquiry undertaken by participants to improve the rationality and justice of:

- our own social, educational practices,
- our understanding of these practices,
- the situations in which the practices are carried out.

14. Conclusion and Reflective Comments

The research experiences here are not the full story, but the issues and techniques discussed in this paper may help research work better for you, as you attempt to do research with full-time work. This can be done by:

- making careful choices with the research field,
- devising a research proposal plan that uses ethical guidelines and proper project management techniques
- using the literature review as a tool to extract the gap, refine and focus the thesis,
- finding worthwhile, efficient research methods for data collection and analysis.

I hope that paper helps research work for you by greater acceptance of the responsibilities, by reading widely what others have done and in doing so, avoiding the many pitfalls, with your supervisors to guide you along the road to completion.

References


