The situation of Mount Lofty was found from hence and from some other cross bearings, to be 34°59'south and 138°42'east. ... was then 5 fathoms, and we dropped the anchor at a bottom of sand, mixed with pieces of dead coral.
Quality in Postgraduate Research:
Research Education in the New Global Environment

Refereed proceedings of the 2008 Quality in Postgraduate Research Conference

Adelaide, Australia

April 17-18
2008

Edited by
Margaret Kiley and Gerry Mullins
Peer Review was conducted on all of the papers in this publication. Each paper was sent to three independent referees either in Australia or overseas. All names and identifiers were removed from the papers prior to being sent for review.

Comments from the referees were forwarded to the respective authors and the editors checked the final manuscript to ensure that the referees’ comments had been addressed.
The Editors gratefully acknowledge the assistance of the referees listed below. In order to offer support for inexperienced referees we invited our experienced referees to agree to their reports being sent to less experienced colleagues who had offered to review the same paper. We sincerely thank those experienced colleagues.

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<th>Gerlese Akerlind</th>
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<td>Royal Melbourne Institute of Technology</td>
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**The PhD in the global knowledge economy: Hypothesising beyond employability. 55**
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The 2008 QPR conference builds on the theme of the 2006 conference, "Knowledge Creation in Testing Times" which reflected some of the recent developments in research education. For example, research students were referred to as “knowledge workers” in an environment where knowledge and the creation of knowledge is seen as critical to the development of a knowledge economy.

The theme for 2008 recognises that the environment in which that research is conducted is constantly expanding and changing. Universities find themselves challenged to fulfil their role in today’s global knowledge economy. The role and impact of research education in the modern university is critical in this debate. The theme of the 2008 QPR conference, Research Education in the New Global Environment, will provide an opportunity to explore these issues.

Papers were invited for these proceedings that addressed the following themes:

- The university in an international knowledge society
- The implications of the Bologna agreement for research education
- The impact and evaluation of research education within quality assessment frameworks
- Developments in research education in Asia
- Educating research students for employment in a global environment
- Changing conceptions of quality over time and place
- Globalisation and capacity development
- Managing the quality of research education in different environments
- Student and supervisor development in a changing world.

Five papers are published in this volume following review by three reviewers. Of interest in the reviewing process, for the first time, the QPR Editors decided to develop a system for assisting less experienced reviewers. Hence, we invited the experienced reviewers we have involved previously if they were happy to review and then have their review report forwarded to a less experienced colleague who would have reviewed the same paper. We had a very warm and positive response to this invitation. We also had a positive response from less experienced colleagues who offered to review under such circumstances. Hence, for each paper we had three reviewers, two experienced and one less experienced.

Of all the themes outlined above, only one was actively addressed in the papers published, that is, educating research students for employment in a global environment, the first and last papers are both related to employment and the doctorate. The first, authored by Adams et al, examined employers’ views of engineering doctoral graduates. The paper goes some way towards overturning the anecdotally-based assertions that employers are unsatisfied with the products of doctoral education and unaware of what is involved in research education. The paper by Pitt comes from a very different perspective and describes a research project examining the ‘fitness for purpose’ of the doctorate for employment within a global knowledge economy. A number of the presentations at the conference are also examining issues of employability, skill development for future employment and life after the doctorate: this represents a shift in focus from previous conferences.
Addressing a very different issue in doctoral education, Clerke and Lee discuss methods for assessing doctoral research, including a research portfolio. Such a proposal is timely given the national focus on the development of e-portfolios throughout the education process, including the doctorate.

Considering the entry into, rather than the exit from, a research education experience Jepsen and Neumann report from their research that students in Psychology are unlikely to make any significant changes to their plans for future study in a third year semester, despite several talks on alternatives e.g. Honours, Masters and Doctorates. Such a finding leads us to ask the question: when do students make decisions regarding future study and under what conditions?

The paper by Morris, written in the voice of Chris, a doctoral candidate, engages in a process of discovery related to the rules and procedures related to the authorship of academic papers. It is interesting to consider such issues from the perspective of the candidate, issues which are even more fraught and complex when the candidate is involved in an industry related project, for example one funded through an Australian Research Council Linkage [with industry partners] project.

As an aside, it is interesting the note that the number of papers submitted for refereeing was less than half that received in 2006 suggesting the substantial change, at least in Australasia, to authors’ views of refereed conference proceedings.

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Research Education in the New Global Environment

**Postgraduate research education and the engineering workplace: Employers’ perspectives**

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Gerry Mullins  
The University of Adelaide, Australia

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**Abstract**

This paper explores the beliefs employers hold about Engineering higher degree research (HDR) experience, its value to industry, and the types of work in which these research graduates are engaged. The findings that emerged from discussions with employers reflect varied notions of innovation and its relation to creativity in the Engineering workplace. They also reveal inherent contradictions in employers’ simultaneous valuing and criticism of the qualities of autonomy, independence, determination, persistence, and attention to detail developed within the higher degree research experience. The findings, which form part of a larger study into the accommodation of Engineering HDR graduates by the Engineering workplace, are useful to Engineering students contemplating HDR study, to candidates seeking better insight into potential non-academic professional roles, to Engineering discipline academics interested in the development of professionally relevant HDR programs in Engineering, and to employers seeking to attract and retain Engineering researchers.

**Introduction**

The development of advanced technological knowledge and innovative ideas is viewed by industrial nations as a way to maintain industrial and economic competitiveness, and postgraduate research education and training are identified as a means to develop the workers necessary to fuel this drive for increasing innovation and productivity. The impact of these views was felt by Australian universities following federal government policy that altered the funding of research training in Australian universities (Kemp 1999a). The importance attached by government to science and technology as drivers of commercial innovation was further evident in the commitment, in 2001, of 8.3 billion dollars over a ten year period to strategic funding for science and innovation (DEST 2001), with the aim of fostering new ideas through research and bringing them into practical, commercial usage. In Backing Australia’s Ability – Building Our Future through Science and Innovation (DEST 2004), 45% of the funds earmarked for research were directed at engineering developments.

The importance to industry of postgraduate education and training in Engineering was highlighted in submissions to the West Review (DEETYA 1998). These called for a broad range of employment related generic skills and personal attributes deemed desirable in both graduates and postgraduates, such as problem-solving ability, motivation, and communication skills (B-HERT 1997); funding for university infrastructure and technology to allow research to remain regionally competitive (ACED 1997); and closer collaborations between universities and industry in general, with further development of ‘industrial’ postgraduate programs to meet the needs of industry (Walker 1997). The substance of the submissions reflected what Brennan et al. (1996) described as a common perspective presented in the literature relating Engineering education...
and industry (e.g. Clark 1996; Farrell 2007; Osborne 1997; Whiston 1993): the aim to ensure that Engineering and Applied Sciences postgraduates are appropriately trained to meet perceived industry needs.

One rationale for the need for change to higher degree research (HDR) education was the view put forth that ‘Employers, in particular, have expressed concern with the standard of communication, interpersonal, presentational and leadership skills of research degree graduates, and comment that they are commonly too narrow, too specialised and too theoretical’ (Kemp 1999b, p. 31). Comments to the higher education community by Gallagher (2000) reinforced this view. Kemp substantiated these views in large part with findings of the Wills Review (Wills 1998), which referred to the West Review (DEETYA 1997) for evidence of employer dissatisfaction. Of the 377 currently accessible submissions made to the West Review, only a handful of employer submissions make any reference to HDR graduates and of these, it appears that only the submission from the Business/Higher Education Roundtable (B-HERT) was critical of postgraduate research degree holders. Specifically, the submission asked for improvements to ‘advanced level graduate preparation’ so that graduates become more commercially and financially skilled; better trained in project management, including its social and “political” implications; understand the principles of organisation, and importance of the timely completion of projects; and display leadership and team membership skills.

The suggestions made in the B-HERT submission to the West review reflect point for point those expressed in an earlier B-HERT report into the development of research and development (R&D) leaders in Australian (Mann et al.1994), which recommended that universities do more to ensure that graduates had the necessary skills and attributes to perform well as research and development managers in Australian industry. The report is largely critical of a lack of development of science and engineering students’ leadership skills and recommends that ‘Universities can do more to educate graduates who:

- are focused and applied in the interests and can see the commercial potential of research;
- have basic financial skills and are business “smart”;
- understand basic principles of project management, including planning and organisation of work and completion of projects within a specified time frame;
- have learned leadership skills and effective team membership;
- understand the social and “political” process involved in project management.’ (Mann et al., p. 16-17)

Mann et al. (1994) were not investigating the industry roles of engineers or scientists with research higher degrees; they reported that most engineers in industry leadership positions do not have PhDs. Their aim was to improve R&D management leadership. Thus, in Australia over the past decade, government policy on higher degree research education in all discipline areas was strongly influenced by business concerns about managerial leadership in science and technology firms. What remain unclear are Australian industry employers’ beliefs about and expectations of knowledge workers with Engineering HDR experience and their value to industry. It is reasonable to ask, for example, if Engineering HDR experience is of value to industry.

For many HDR candidates, a goal of the PhD experience is professional development for either scholarly or non-academic roles, or both. As in other academic disciplines, Engineering postgraduate research students develop the knowledge, skills and attributes needed to undertake independent discipline
research in an academic context (Austin 2002; Bieber & Worley 2006; Weidman & Stein 2003). However, most Engineering research degree holders, both here and abroad, appear to seek employment in industry (Enders 2002; LaPidus 1997; Harman 2002). The findings of a recent study of Engineering postgraduate research students in an Australian university concur with this, and also found that many of the study participants were uncertain about what their future professional roles would entail and the value of their research education to employers (Adams et al. 2006).

A key assumption in the present paper is that successful commercial innovation in industry is dependent in part on the research knowledge and capabilities of its professional engineering workforce. However, very little is documented about the ways that research postgraduates fit into a non-academic engineering workplace, or how the knowledge and skills acquired in postgraduate research candidature are perceived and used in industry. A recent Swedish study of industry research doctorates in Information Technology found that students’ learning experiences of research differed considerably depending on the industry environments in which they were placed, and ranged from stimulating and fun to rejecting and devaluing of research (Wallgren & Dahlgren 2005). The research indicated that some apparently research-intensive workplaces are not supportive of the type of learning or knowledge generation that is an essential part of PhD work. However, the study focused on student perception during candidature; little has been documented from the employers’ perspective about the relevance and value of Engineering Masters and PhD experience to the non-academic workplace.

The current lack of employer perspective highlights the gap, mentioned by McAlpine and Norton (2006), between the broad-ranging conversation promoting government, industry and university collaboration (Etzkowitz et al. 2000; Fairweather 1989; Keating et al. 2000) and the lived experiences of students, academics and industry employers. Equipping students with knowledge of the ways postgraduate research experience is perceived and used in the industrial Engineering workplace would assist them in planning their professional pathways, either in academia, research organisations or industry. Insights into employers’ views of the HDR experience would also benefit the higher education arena by

- addressing, in part, the perceived ‘cultural gap’ between the Engineering industrial and academic research environments (Tyler 1998);
- illustrating any misconceptions held by employers of Engineering postgraduates about the nature of HDR education;
- informing efforts at candidature-based generic or professional abilities development to make them more relevant to the professional contexts in which graduates will find themselves.

**Research Methodology**

This paper presents conceptual categories derived using the constant comparative method of data collection and the systematic coding procedures of Grounded Theory methodology (Charmaz 2006; Glaser & Strauss 1967). The concepts presented form part of a larger study in progress, the ultimate aim of which is the generation of a substantive theory that explains processes of accommodation of Engineering HDR graduates by the engineering workplace. In the present paper, a conceptual framework (Glaser & Strauss 1967; Strauss & Corbin 1990) is presented that provides insights into the beliefs, expectations and experiences of employers and reveals the complex nature of their views. ‘Employer’ here refers to an individual who has responsibility for assessing the
suitability of a worker; it does not refer to an entire company or organisation. One benefit of Grounded Theory methodology is its potential to illuminate under-researched or poorly understood personal beliefs in particular social contexts (Miles and Huberman 1994; Stern 1984, in Strauss and Corbin 1990) such as those that influence the professional work practices of Engineering researchers. In this paper, the employers’ views reveal a conceptual framework that links the professional roles and attributes expected of research engineers in industry to the ways in which innovation is perceived in various industry settings.

Snowball sampling, where social contacts and interviewees are asked to recommend other potential interviewees, was used to recruit participants. This technique is particularly suited to inductive, theory generating analysis of populations (Miles and Huberman, 1994), for populations made up of members of small, informal networks or networked organisations, and who are difficult to access without using social networks (Bernard 2002; Cohen et al. 2000; Neuman 1991). In this study of employers, all three of these criteria applied.

In many ways, the employers interviewed in this study are like the elites described by Neuman (1991, p 253):

**Powerful leaders in business, government, and so on are difficult to reach. Assistants may intercept mail questionnaires and restricted access can present a formidable obstacle to face-to-face or telephone interviewing. Access is facilitated when a prestigious source calls or sends a letter of introduction ....Personal interviewing with a high percentage of open-ended questions are usually more successful than all closed ended questions. Confidentiality is a crucial issue and should be guaranteed, since elites often have information that few others do.**

During the course of this study, several participants informally mentioned that they would not have offered to be involved if the study had merely asked them to fill in a questionnaire. They appreciated the opportunity to express complex views candidly.

Fifteen employers of Mechanical and Chemical Engineering HDR graduates were interviewed: nine professional engineers, four research scientist and two administrators. Twelve were directly responsible for hiring postgraduate research trained engineers, two had been responsible until recently for doing so, and one held a position on a national body that entailed the accreditation and employment of professional engineers. The organisations in which the employers worked ranged in size from 25 to 3000 employees and were engaged in a variety of principal activities (Table 1).

The interviews were semi-structured around guiding questions which included the following:

- Why do you decide to employ a postgraduate engineer for some positions?
- What attributes do you believe postgraduate engineers should bring to a position?
- What attributes do you believe postgraduate engineers bring to a position?

Participants were encouraged to discuss their personal views regarding the postgraduate research experience and its relevance for the non-academic workplace. All interviews were audio-taped, and subsequently transcribed. To maintain their anonymity, the employers are identified as Employer (Emp) 1 to 15. Each interview transcript was summarised and sent to the interviewee for comment and correction.
Table 1: Number of employers interviewed, by organisational size and principal activity

<table>
<thead>
<tr>
<th>Number of participants</th>
<th>Number of organisations</th>
<th>Organisational size (Number employees)</th>
<th>Principal organisational activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>NA</td>
<td>Professional representative</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>100</td>
<td>Consulting, testing, product development,</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>25</td>
<td>Product development, consulting</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2500</td>
<td>Industrial design, systems integration,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Resource exploration, production, service provision</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>3000</td>
<td>Infrastructure development, maintenance,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>service provision</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1200</td>
<td>Product and systems development, maintenance,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>service provision</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>2000</td>
<td>Product development, manufacturing</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>60</td>
<td></td>
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</table>

Interpretation and Discussion

None of the employers in this study specifically sought employees with postgraduate research qualifications, but rather sought ‘advanced knowledge workers’ (Alvesson 2004) who possessed an appropriate combination of theoretical and applied knowledge, skills, and judgement necessary to engage in complex problem conceptualisation, advanced problem-solving and contextually appropriate decision-making.

*We don’t necessarily need to employ people that have a research degree but we need certain people characteristics and certain people knowledge and certain people abilities.* (Emp 6)

With varying emphases, all the employers mentioned the following roles and attributes as being part of the professional research engineer role in their organisations (Table 2).

Table 2: Roles and attributes required in advanced engineering work

<table>
<thead>
<tr>
<th>Roles</th>
<th>Attributes</th>
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<tbody>
<tr>
<td>Technical leader</td>
<td>Deep, broad ranging technical and theoretical knowledge</td>
</tr>
<tr>
<td>Problem solver</td>
<td>Ability to transfer knowledge quickly</td>
</tr>
<tr>
<td>Product creator / developer / maintainer</td>
<td>Intelligence for problem solving</td>
</tr>
<tr>
<td>Client consultant</td>
<td>Interpersonal intelligence</td>
</tr>
<tr>
<td>Document writer/checker</td>
<td>Initiative / Results driven</td>
</tr>
<tr>
<td>Technical mentor</td>
<td>Practicality</td>
</tr>
<tr>
<td>Team worker</td>
<td>Commitment to task</td>
</tr>
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</table>
Notions of innovation

The views expressed by the employers in this study can be thematised around notions of innovation. DITR (2007) states that, in a business context, innovation involves the introduction of any new or significantly improved goods, services, operational, organisational or managerial processes. It also states that most innovation in Australian businesses involves the introduction of ideas or products developed elsewhere, with little innovation contributing ‘new to the world’ ideas or technology. This can be compared with the aim of PhD research to make an original contribution to knowledge within a discipline – in other (DITR’s) words, ‘new to the world’ knowledge. One way to view the relevance of research education to industry is to consider how well postgraduates’ experiences of knowledge generation in candidature sit with the innovation goals of business.

Further analysis revealed that these employers placed differing emphases on different roles and attributes, and that their preferences tended to cluster around three distinct role categories, which we describe as ‘niche innovator’, ‘innovative adapter’ and ‘visionary’ (Table 3). Key differences between these roles reflected the need within a company for either individualised, unique product development in response to customer requirements, for monitoring of products or innovations that can be applied to existing practices to create a market advantage, or for imaginative conceptualisations for potential future use. Such differences are reflective of the general pattern of innovation in Australian businesses (DITR, 2007). In the current study there was a tendency for niche innovators to be employed by smaller firms, and innovative adapters and visionaries by large organisations, and for visionaries, in particular, to be employed by government and semi-government funded organisations.

Table 3: Key roles and attributes (in italics) of role categories identified from employers’ comments.

<table>
<thead>
<tr>
<th>Niche Innovators</th>
<th>Innovative adapters</th>
<th>Visionaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge creator for product development</td>
<td>Technical knowledge</td>
<td>Future development anticipator</td>
</tr>
<tr>
<td>Product developer / maintainer</td>
<td>‘gap filler’ for product development</td>
<td>Scenario builder</td>
</tr>
<tr>
<td>Client consultant</td>
<td>Field scanner (assessing readymade products)</td>
<td>Knowledge ‘builder’ for an unknown future</td>
</tr>
<tr>
<td></td>
<td>Team leader (technical, financial, people manager)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Document writer/ checker</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Technical mentor</td>
<td></td>
</tr>
<tr>
<td>Deep, relevant technical and theoretical knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Practicality (technical focus)</td>
<td>Broad ranging technical and theoretical knowledge</td>
<td>Deep technical and theoretical knowledge</td>
</tr>
<tr>
<td>Responsiveness to product development lifecycle</td>
<td></td>
<td>‘Rampant curiosity’</td>
</tr>
<tr>
<td>Intellectual curiosity</td>
<td>Practicality (commercial focus)</td>
<td>Imagination</td>
</tr>
</tbody>
</table>

1 An earlier version of these findings (Adams et al. 2007) was presented at the Australian Association of Engineering Education conference, 2007.
Niche innovators create knowledge that can add novelty to products and services, thus providing the company with a commercial advantage in the globalised marketplace. This strategy was described by Employer 6, the CEO of a specialised engineering company:

"...we do have a stated objective to be a leading edge company in the fields that we work in.... And that to us is a survival strategy. We kind of see that manufacturing is under pressure as such because of cheaper labour countries becoming more prevalent, so anything that doesn't have some degree of difficulty incorporated in it isn't going to survive very long. So education and knowledge are things that are not easily copied and so we base our business on knowing how to do things and developing new and better products and services." (Emp 6)

Innovative adapters used their advanced knowledge to identify, understand and adapt existing knowledge products, created elsewhere, to develop improved company products and services. Employer 7, an engineering executive in a large organisation, referred to this 'off the shelf' approach:

"If we decided to focus on an area then we’d want someone who is capable of research into who the parties might be that we could collaborate with - other businesses - or who has technologies that are available off the shelf that could be factored onto some other technology that we can buy, perhaps off the shelf." (Emp 7)

Employer 4, another employer of innovative adapters, identified their role as engineering knowledge ‘gap fillers’:

"We have a post grad engineer working amongst that team and he’s been working on filling in the gaps in missing data we’ve got so that he’s able to actually create an engineering baseline that the others can then work from." (Emp 4)

As well as the difference associated with knowledge creation and adaptation, two additional differences were found between the employers of niche innovators and innovative adapters: the importance they place on relevance of engineering knowledge gained in candidature, and the character of desired commercial acumen. Employer 2 introduced the expression ‘niche’ to this study, and placed great value on the depth of knowledge acquired through postgraduate research experience:

"... post graduate experience gives you a much greater depth in particular niche areas and hopefully greater breadth as well by virtue of having to deal with a whole range of issues in getting deeper and deeper into one particular niche area." (Emp 2)

Companies seek innovative adapters, not for the specific technical and theoretical knowledge gained relevant to their postgraduate research study, but for their general research-related knowledge, skills and attitude.

"We’re employing those people because of the skills that they bring, their knowledge generally that they’ve acquired through their degree and how well they’ve done their course, the type of person they are, their personality and so forth, those sort of attributes would be worth more to us, or judged more highly I would say. The PhD is sort of nice to have but we won’t then directly use it." (Emp 7)
The non-technical roles expected of advanced engineers differ for niche innovators and innovative adapters. In niche market firms, due to lower staff numbers and the uniqueness and specialisation of products, an advanced engineer is expected to play an integral role in product conception, production, maintenance and ongoing development (the product development lifecycle). Technical practicality is valued in this role, as described by Employer 3.

In all the stuff we do, you’ve got to get in there and you’ve got to be able to know [how to use] a screwdriver bolting something up... it’s not really anything too technical, it’s not something like welding or anything like that where you have to be a bit more specialised but just the commonsense of we’ve got to plumb something up so we’ve got to get some hose...the ultimate post grad for us would be someone who was qualified as a plumber and as an engineer. (Emp 3)

In some innovative adapter firms, involvement in physical production and maintenance processes may be more limited, and commercial practicality, including management ability, is viewed as essential to the advanced engineering role.

...you’re executing if you like, applied work and if they are going to help to do that then they have to be aligned with those goals which includes those things...such as you know, liaising with people, cost and schedule, all those things as well. (Emp 4)

However, commercial acumen, and hence commercial practicality, was strongly emphasised by Employer 7.

When I mean commercial I mean having the smarts to go and negotiate contracts and large contracts and negotiate deals if you like and understand discounted cash flow and profit and loss accounts and you know, income statements and all that sort of stuff, it’s all part of doing business deals and putting projects forward and so forth, or running a business... (Emp 7)

Visionaries work to prepare some organisations for potential future developments. In this study, visionaries were valued mostly in government or semi-government institutions where a small proportion of funding (approximately 10%-15%) is available for what was commonly referred to as ‘blue sky’ research.

Well [organisation] is charged with pushing back the frontiers to a significant extent, it is not routine engineering in the sense of using existing knowledge, it is about generating new knowledge in particular areas that are relevant to [organisation’s focus]. So whether we employ engineers or scientists is often a secondary consideration and the primary consideration is whether this is a person who, usually demonstrated through a post graduate degree programme, has shown that he or she can exhibit the sort of skills and attributes that we’re looking for which includes primarily a rampant curiosity and an ability to go where others haven’t gone, if you can use that language. (Emp 10)

But you know, it is the new, it is the futuristic. It is looking at what is out there in science and drawing down on it ... And what would we as modellers and simulation people have to do, to understand that and make a case for it in the future. So it is all, it is the research into new technologies, new ideas, new concepts, new ways of working. It could be, but anything that is sort of outside what a client here and now wants. (Emp 15)
Niche innovators share visionary characteristics; however they are kept more stringently under check by budgetary pressures within the organisation. In some firms that seek niche innovators or visionaries, HDR engineers are expected also to engage in some innovative adapter work. However, every employer interviewed for this study indicated a preference for one of these innovator types, which suggests that providing Engineering research students with information about the ways innovative work is perceived in industry would assist them to both plan candidature and seek employment according to their preferred work style and professional goals.

Although the differences between niche innovator, innovative adapter and visionary roles strongly impact on the type of knowledge work expected of a research engineer, conventional Engineering higher degree candidature provides the opportunity to develop much of what is expected by any of these employers. Nevertheless, any attempt to prepare Engineering postgraduate research students for professional roles in industry would benefit from consideration of these different ways knowledge is created and/or used in various industrial contexts.

Opposing demands

Employers’ comments for this study were frequently complex and presented a richer perspective than is provided by listings of desirable generic skills or professional attributes. Their comments reflect an inherent tension in their need for employees with the depth and breadth of technical and theoretical Engineering knowledge gained during HDR candidature, their valuing of persistence, determination and independence evidenced by the completion of a postgraduate research degree, and their simultaneous criticism of candidates’ tendencies toward isolation, perfectionism and propensity for theory driven problem solving. Criticisms such as these have driven much of the postgraduate research reform agenda in the past decade; however, the employers’ perceptions in the research presented here suggest that the experiences that are believed to develop undesirable qualities in Engineering research graduates are the same experiences that develop desirable qualities. The passages that follow, from Employers 9, 11 and 13, illustrate simultaneous opposing demands and beg the question, ‘How much deep theoretical and technical knowledge, development of personal discipline and persistence, and practical experience is achievable in a 42 month candidature?’ The following comments made by Emp 9 acknowledge the value of well researched, knowledgeable documentation, yet complain about the length, detail and practicality of it.

Emp 9:

Their ability to actually sit down and apply themselves, work alone and come up with reams of documentation just simply amazes me...their ability to work alone and do lots alone has brought enormous benefits. So if you hit a problem and you wanted somebody to put together just a preliminary thought about the ideas and all of the options ... very rarely you’ll find they would have missed something... their ability to put together a thinking document that other people can comment on, I think is enormous benefit for an organisation.  

...whereas, would somebody actually read it? That is the question. It’s testing out their thinking with the ‘doers’ because if the ‘doers’ think the guy is talking nonsense, I just think it finishes him...people don’t take him seriously anymore...
Employers 11 and 13, and several others, valued the characteristics of independence and autonomy displayed by HDR graduates in the workplace, but also pointed out the difficulty some have working with colleagues.

Emp 11:

> if someone’s got a postgraduate degree it tells you that they’ve reached a certain level of understanding, but also problem solving ability. Also independence of work... if someone’s coming to you with a higher degree then they’ve probably had a certain amount of autonomy already. They’re used to working by themselves, they’re used to working under a certain amount of pressure as well.

Occasionally dealing with other people, work colleagues that sometimes can be a problem. If people have come from a university environment, sometimes a work environment can be a little bit different and yeah sometimes they struggle to deal with other people that do things perhaps differently.

Emp 13:

> It’s very dependent on the nature of the research that they’re doing [in the organisation]. However the nature of some of the work that some of the graduates that we take on board is that it’s very isolated so they may be contributing to a larger project but they’re generally working in isolation...

...in some cases they are required to go straight into a team and work as part of a team and in those instances, yeah, there have been some reports of the individual not necessarily communicating well with others in terms of where the status of the project is or communicating problems and trying to handle everything by themselves.

... there is need for the person to be able to work on a largely independent level but still able to integrate within a wider scope of a team.

These examples of opposing views are not presented to discredit the employers who expressed them, and in fact they illustrate the complexity of roles, skills and attributes required of research engineers engaged in industry work. However, they serve to highlight the difficulty of attempts by universities to develop relevant, non-academic generic or professional skills in HDR students during candidature.

**Conclusion**

Greater insight into the ways in which the knowledge and skills gained during research candidature are understood and used in the Engineering workplace is important. It can enable Engineering postgraduate research candidates to reflect in a more informed way on their preferred professional pathway, can inform the provision of generic skills training for Engineering postgraduate research students, and can enlighten dialogue between universities and industry employers concerning the potential for Engineering research graduates to contribute to innovation and the competitiveness of Australian industry.

In this study, interviews with employers of Engineering HDR holders in Engineering revealed three notions of innovation that have relevance for the professional experiences of engineering researchers in their organisations. Only two types of innovation, niche innovator and visionary, appear to rely on the creation of new knowledge for application within the organisation, suggesting
that engineering firms that make use of these innovator roles value the creativity and capacity for new knowledge generation that are nurtured during HDR candidature. Candidates who wish to continue work which allows some scope for creativity and the pursuit of new knowledge, but who do not wish to pursue an academic career, might find niche innovator or visionary work more satisfying than an innovative adapter role. Decisions about research topic and type of research candidature can be made in light of this reflection.

The employers’ comments also reveal the complexity of their expectations. While it is the case that they want employees who work well with others, who can communicate in ways that are accessible to a range of audiences, and who can engage in group problem-solving activity, many of these employers valued highly the ability of HDR graduates to work in isolation, to produce creative, detailed, accurate documentation, and to work persistently and consistently under pressure. The tensions revealed in their contradictory expectations contrast with the certainty implicit in criticism wielded against traditional research education found in Gallagher (2000), Kemp (1999a; 1999b) and Mann et al. (1994). It is clear in many of the employers’ comments here that the traditional outcomes of HDR education, and doctoral education in particular, are of real value to employers of Engineering HDR graduates.

Despite suggestions for ways universities might improve research education to better fit their specific organisational needs, all the employers expressed general satisfaction with their experiences of employing engineers with postgraduate research qualifications. In the words of Employer 7, arguably one of the most critical of the employers interviewed,

... but people who’ve done a PhD I generally think they do, you know, I think they do very good work for us. (Emp 7)

References


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Mainstreaming the doctoral research portfolio?

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Abstract
The doctoral research portfolio has come to be considered a viable form of doctoral output in a graduate education field that has experienced spectacular growth and diversification since the early 1990s. It is often argued that, as a flexible form of doctoral production, the portfolio has the potential to evidence both textual products and graduate capabilities due to its capacity to accommodate a range of media forms and delivery contexts that address various scholarly and professional practice communities. At the same time, uptake of the portfolio in different doctoral programs has been more limited than the rhetoric of diversification might suggest and has remained largely confined to creative arts and professional doctorate programs. It has also not been well documented in the ‘mainstream’ literature on doctoral education. This paper argues that the idea of the portfolio is complex and difficult to implement. At the same time, pressures on the doctorate in terms of outcomes increasingly suggest a direction towards opening up the doctorate to embrace an increasing diversity of forms of production. Within this context the portfolio as an idea may become more useful in directing attention to more creative conceptualisations of the ways in which students may evidence doctoral achievement.

Introduction
The research doctorate has undergone unprecedented change in the past ten years, in response to major shifts in the role of the university and the disciplines in knowledge production and the management of intellectual work. The traditional PhD has expanded to engage with a much wider range of practices and outcomes and with more diverse student populations, notably the increasing proportions of international students and doctoral graduates who do not take up academic careers. New kinds of doctorates have been established that have expanded the scope and direction of doctoral education (Malfroy & Yates, 2003, Park, 2007, Boud & Lee, in press).

Accompanying this diversification are policy-led demands for doctoral education to be more industry-focused (McWilliam et al, 2002) and for graduates to be autonomous researchers, industry-ready and more recently, to be ‘creative’ (Usher 2002). These changes have challenged universities to design and deliver innovative and more flexible research programs that produce doctoral output suitable for the academic community and a range of professional practice communities.

These developments have opened up a space for questioning the nature of doctoral output more generally beyond the traditional textual product itself (the thesis, or dissertation) to encompass the notion of doctoral capabilities (eg, in Australia, the Australian Qualifications Framework 2002). In this space, new and flexible forms of knowledge products can be developed to represent graduates’ achievement of research capabilities as well as tangible or concrete forms of their doctoral output. Enter the doctoral research portfolio.

Over the past decade and a half, the doctoral research portfolio has functioned within different research fields as a vehicle that holds a collection of artefacts grouped together by a theme and explicated by an interpretive text or exegesis.
Quality in Postgraduate Research


Increasingly, as this paper argues, the doctoral research portfolio is being ‘mainstreamed’ into debate about doctoral research production more generally. At the same time, it appears that actual practices have not changed as rapidly or as radically as the theoretical literature might suggest. There is evidence that, while the portfolio is well entrenched in creative arts doctorates (Barrett 2004), the actual uptake of the portfolio in other doctoral programs, including professional doctorates, has been more limited than the rhetoric of diversification might suggest (Neumann 2008 in press). The design and implementation of doctoral research portfolios have also not been well documented in the published literature, neither in the professional doctorate, nor in the ‘mainstream’ literature on doctoral education. Exceptions are a small number of case studies, notably Morley & Priest (2001) and Allpress & Barnacle (2008, in press).

Neumann’s research suggests that, the doctoral research portfolio is complex and difficult to implement for supervisors, students and examiners. At the same time, our own inquiries indicate a steady and increasing uptake of the portfolio within publicly available program descriptions on university websites and the like. In light of these recent developments, this paper discusses the implications for doctoral education of what we might call a gradual ‘mainstreaming’ of the doctoral research portfolio in terms of its flexibility in accommodating different kinds of knowledge production in various genres to a range of different audiences, while still evidencing doctoral level ‘standards’.

This paper reports on a survey undertaken by the authors into Australian and UK universities that offer portfolio-based pathways to doctoral degree outcomes. Motivated by the paucity of systematic documentation and the lack of accumulated knowledge about this important development, the paper seeks, first, to provide an overview of the context of change in doctoral research that is driving the pressures on doctoral outputs and increasing attention on the portfolio idea. Second, we describe selected examples from the survey in order to outline the existing scope and range of portfolios and third, we discuss a set of issues arising from this analysis and pertaining to the portfolio’s capacity to evidence doctoral output.

Context of change in doctoral education

Since the 1990s, there has been a considerable increase in worldwide doctoral production coupled with an increasingly international doctoral student body. This has raised a number of concerns about the effects of globalisation on doctoral education. Arising from the UK, one response has been a move towards standards and descriptors that transcend national systems and focus attention on the capabilities of doctoral graduates to participate in the global ‘knowledge economy’.

In Australia, other factors have impacted on these standardisation processes, including the Dawkins-initiated restructuring of the binary higher education system, the transition into the university of professional fields such as nursing, psychology, IT and design, the introduction in 1990 of the professional doctorate, and government-mandated policy changes and guidelines for doctoral education. In the light of these changes in the higher education sector, there is a clear imperative for Australian universities to move towards a focus on questioning ‘what is doctoral’ in order for their doctoral degree programs to be describable in international terms and in terms of explicit graduate
capabilities. But first, a brief overview of recent policy-mandated changes and guidelines for doctoral programs and production in Australia.

The introduction of the Research Training Scheme in Australia in 2001 resulted in a reduction in government-funded places for domestic students at doctoral level, 'masked by an increase in full-fee international research students' (Evans et al 2005, p. 29). This tightened funding situation has forced universities to more closely scrutinise candidate application processes to ensure shorter time-to-completion and lower attrition rates that has led to an ‘emphasis on monitoring and review of program quality’ (Manathunga et al, 2004, p. 244).

In its Doctoral Degree Guidelines, the Australian Qualifications Framework (2002, 2007) has in recent times both expanded the range of what can count as doctoral research and formally acknowledged the expansion of what can count as outcomes of that research:

A graduate of a Doctoral degree program is able to:

- carry out an original research project, or a project(s) addressing a matter of substance concerning practice in a profession at a high level of originality and quality; and
- present a substantial and well ordered dissertation, non-print thesis or portfolio, for submission to external examination against international standards (2007, p. 71).

While this description expands on the more traditional PhD dissertation requirements, doctoral evaluation criteria are affirmed as being ‘the quality of the research, the candidate's ability to communicate the significance of the research, and the candidate's ability to work as an independent researcher’ (CADDGS 2005b, p. 2).

These statements clearly indicate a broadened range of doctoral output, articulating international standards. Of interest here too, is a now-familiar conflation of graduate (capabilities and achievements) and output (the 'product'), expanded here to include new forms and media of production.

In response to the AQF guidelines (and expanding on their own earlier professional doctorate guidelines [1998]), the Council of Australian Deans and Directors of Graduate Studies’ Framework for Best Practice in Doctoral Education in Australia (2005a) now encompasses all supervised doctorates, and in its Framework and Context Statement for Best Practice in Generic Capabilities for Research Students in Australian Universities (2005c), generic capabilities are defined as follows:

_The Framework and these guidelines use the term generic capabilities (GC) to refer to the body of skills that have a direct link to higher degree research (HDR) students’ employability. This refers to both (a) workplace entry or (b) career development and change for those already in employment. Generic capabilities was the term selected for use in a national DEST funded study in 2002 to which 34 universities responded. This term was selected for the emphasis on employability skills (p. 3)._ 

With a clear link between generic capabilities and graduate employability, these guidelines have the potential in the coming years to significantly affect universities’ doctoral candidate recruitment, selection, program structure, progression indicators and examination processes, though it is probably fair to say that these effects are as yet indirect and emergent. Australian universities are being encouraged to refine existing policies, identify explicit generic capabilities and to ‘determine the most effective means of delivering the body of research-enabling skills (beyond reliance on informal processes) to ensure their
broader contribution to employability and personal development’ (CADDGS 2005d). This directive underpins the current imperative for universities to reconsider, describe and formalise what ‘doctoral’ might actually look like in terms of the graduate and their research output.

Based on the AQF (2002) guidelines, the CADDGS Framework for Best Practice in Doctorates (2003) emphasises the importance for universities to conduct inventories that identify the timing, amount, method, type and focus of suitable activities offered all research students in relation to generic capabilities, focusing on the ‘transferability of research skills’ (p. 2). These activities require the supervisor to ‘assist the research student with “career advice and development”... [and to have] a significant role’ (p. 5) in the development of discipline-specific, research-related skills, as well as general skills such as technological literacies and ethics. This means that supervisors are to perform as academic mentors, with the implication that, where appropriate, universities revise their supervisory training and development programs. Universities also have an explicit responsibility for the ongoing development, evaluation and resourcing of ‘an open, collegial, and productive learning environment, with coordinated programs of activities’ (p. 6) and that this is communicated to the university community. This means that universities assume responsibility for equipping graduates with employment-linked capabilities while they produce doctoral research output.

These excerpts illustrate the policy-led imperatives that are currently driving universities to articulate, on the one hand, generic capabilities that are acceptable to funding bodies and industry employers and, on the other, flexible and innovative programs that attract a diverse student demographic increasingly interested in doctoral research in professional fields (Evans et al 2005).

These changes in the university operating environment and research knowledge production have prompted a ‘radical review of what counts as expertise’ (Lee 2005, p. 77). This is particularly so in the context of a research student profile transformed in Australia since the participation of professional and applied fields in doctoral research education, that has also contributed to ‘the acceptance of knowledge produced in the context of application’ (Barnacle 2005, p. 180). Clearly, the impetus in this contemporary setting in Australia is for a re-evaluation of what constitutes doctoral research, prompting academics to think creatively about doctoral programs in terms of processes and output. Re-enter the doctoral research portfolio.

**What is a doctoral research portfolio?**

This section discusses the key terms in this paper: ‘portfolio’ and ‘exegesis’, as well as ‘thesis’ and ‘dissertation’, in order to establish some clarity in terms of usage, and to signal some of the key elements of the debates that are currently being held about conceptions and practices of doctoral production. The exegesis has an integral, albeit contested, relationship to the portfolio, as we will see in the discussion of critical and emergent issues in section four of this paper, while the ubiquitous terms ‘thesis’ and ‘dissertation’ are largely co-terminous in Australian usage, at least.

There are few explicit definitions of ‘portfolio’ in relation to doctoral research in the scholarly literature outside the creative arts fields. The term seems to operate implicitly as a kind of vehicle or container that holds a collection of doctoral products in various media forms accompanied by an exegesis or linking paper. A useful working definition was provided by Walker in 1998, in relation to Deakin University’s Doctor of Education (now Doctor of Philosophy [folio]) program:
A (port)folio consists of a selection of products of research which best establishes the candidate’s claim to have carried out research of a doctoral standard (p. 94).

This definition refers to a range of doctoral research products that affirm candidates as industry-ready, independent and creative researchers. This suggests that the portfolio’s strength is its capacity to demonstrate a breadth of material outcomes of research that potentially enhance its significance and impact to different academic and professional practice communities. In this sense, the doctoral research portfolio has the potential to fulfill the CADDGS (2005b) doctoral examination guidelines for evaluating the ‘quality of the research, the candidate's ability to communicate the significance of the research, and the candidate's ability to work as an independent researcher’ (p. 1).

According to Krauth (2002), the term ‘exegesis’ originated as an explanatory text for the Scriptures because canonical texts were so important to the culture that they needed explanation. Krauth explains that more recently in journalistic terms, the exegesis operates as a critique of creative output, telling the culture through the mass media, whether a work is valuable or merely tangential to culture. However, he criticises this popular conception of the exegesis, suggesting that in this context, it is more about taste and fashion than it is about the ‘meanings and workings of the creative piece under consideration’ (p. 3). Krauth argues this role has also been performed by universities, with the contemporary purpose of explaining theory and/or philosophy to the culture.

According to the New Shorter Oxford Dictionary (cited in Maxwell & Kupczyk-Romanczuk, 2007, p. 2), a ‘thesis’ is defined as a proposition that is maintained by argument, while a ‘dissertation’ is an extended scholarly essay that expounds or maintains a thesis or proposition.

These definitions are by no means conclusive, but are helpful for explicating the relations between them in the following discussion arising from a survey of universities currently using doctoral research portfolios.

The survey included an extensive websearch using the key terms ‘doctoral education’ or ‘doctorates’, and ‘portfolio’. The results show that increasingly in Australia and to some extent the UK, various universities use the portfolio in doctoral research programs similarly to those used in teacher professional development. That is, as a body of evidence of the candidate’s achievement through their degree, including coursework outcomes and a substantive research component presented in the form of a dissertation.

Several of these universities, such as Queensland University of Technology, University of New England, Curtin, University of Ballarat and James Cook, restrict the use of the portfolio to their professional doctorate in education, although the structure, purpose, form and contents varies in each institution. Generally in these professional doctorates, the portfolio holds a collection of material outcomes in a range of media forms as evidence of a candidate’s progression, and sometimes for examination, and is usually accompanied by some kind of explanatory or critical text. The University of Ballarat for example, states that the research component:

may take the form of a single research report, or a bound series of research reports accompanied by an exegesis...[that] elaborate[s] the line of enquiry and investigation pursued in preparation of the reports and provide commentary on individual reports overall. The length for any one report would normally be 7,500 words or equivalent, or...any other combination of research output totalling around 60,000 words or equivalent (2006, p. 27).
The folio in the University of South Australia’s professional doctorate contains a number of items: a thesis (meta-analysis) of 20,000–25,000 words comprising an overview of the research agenda, a summative argument and original contribution to scholarly knowledge and practice; three research projects reports (two x 10,000 words, one x 35,000 words) on issues related to professional knowledge and practice; optional support materials such as published papers, policy documents, curriculum materials and web-pages, etc. Each portfolio item is bound separately and presented in a ‘suitably sturdy and professional looking folder wallet or box’ (August 22, 2007).

In the UK, and described as a Practitioner Research program in a ‘pan-institutional framework’ (August 22, 2007) the Doctorate in Professional Studies at Middlesex University is an extension of the university’s approach to work-based learning. Structured in two parts, the first reviews current learning, awarding credit points for Recognition and Accreditation of Learning (usually against a Masters award), for capabilities for professional knowledge and project capacity, completed substantial work projects, and planning for a major research project. In Part two, candidates undertake ‘one or two large-scale research and development projects’ (August 22, 2007).

The portfolio comprises the material outcomes of the entire program, but what distinguishes this program is the strong supervisory and examination base for the project, operated with colleagues in partner universities and organizations. An overall program external examiner reports to the academic board on the ‘conduct, rigour and fairness’ of the biannual DProf assessments, while candidates work with a specialist internal tutor and an external program consultant. Assigned from the relevant professional field, the external consultant attends the proposal presentation, reads and comments on submissions, and also attends the final presentation as observer. Two specialist external examiners, each representing academic and professional fields, attend the final project presentation similarly to the PhD viva defense.

Also in the UK, Northumbria University’s Professional Doctorate portfolios are used to demonstrate candidates’ substantial engagement with professional practice over a period of time. They include ‘both an overriding line of argument and a critical commentary which sets the material in a theoretical and professional context’ (August 22, 2007), and a body of published work or innovative practice. The portfolio as a whole is taken to be the original contribution of the research, with the commentary comprising 15,000 words. The ‘material’ includes published journal articles, strategic organizational or evaluation reports, policy documents, CD Rom and web work, videos of practice interventions, innovative development methods for professional practice and feedback on any of these elements.

Overall, the most common forms that we found in the research component of the professional doctorates were the following:

1. A smaller scale research project than that required of a Doctor of Philosophy degree, but intended to be evaluated by the same criteria;
2. A requirement to complete more than one research project;
3. A portfolio approach which allows for the submission of a series of documents rather than a single dissertation; and
4. Published or publishable outcomes.

The examples above describe the various ways in which the portfolio operates within professional doctorate programs. Of more interest to this paper however, are programs that use the doctoral research portfolio as an alternative to the PhD thesis. In these cases, the portfolio can be seen to transgress the boundary
of the professional doctorate and the creative arts fields, retain its creative and flexible characteristics, and yet still represent substantive academic rigour and critical analysis demonstrating ‘doctoral’ quality. The following discussion focuses on the articulation of the doctoral research portfolio into each of the following programs – Deakin University’s Doctor of Philosophy (Folio), Royal Melbourne Institute of Technology’s (RMIT) Doctor of Philosophy by Project and the University of Western Sydney’s Doctor of Cultural Research (DCR).

Deakin’s PhD program in education offers a single doctoral degree with two research ‘pathways’, by Thesis or Folio, the latter interestingly renaming the Doctor of Education as a PhD. Each pathway is differentiated by curriculum orientation and the product submitted for examination. Candidates may transfer between pathways through the preparation and colloquium defence of a research proposal. The folio program has no coursework and is oriented towards ‘extending educational practice rather than being devoted wholly to the pursuit of a single original contribution to knowledge in a specialised discipline or academic field’ (August 22, 2007). It caters to professional educators or people whose work has an educational orientation. Candidates enrol part-time to maintain a close connection to their professional context so the research is grounded in, and applied to, professional practice. The overall folio word length is 85,000, comprising a dissertation of 40,000–50,000 words that demonstrates a contribution to professional theory and/or workplace knowledge and practice. The folio supports and extends ‘the argument presented in the dissertation with (between two and four) representations’ (August 22, 2007) of professional writing and practice such as exemplars of professional scholarship, publications, reports, online/electronic resources and policy documents, each between 5,000 and 10,000 words.

RMIT has a single Doctor of Philosophy that ‘involves submitting a thesis or project for critical review by a panel of experts in the field of study...[and demonstrates the candidate’s]...capacity to work independently of supervision’ (2007, p. 13). The university deems each form to be ‘equivalent but different...[as]...in some cases research questions might be more appropriately explored through the process of a project rather than a thesis’ (p. 38). Although the program is university-wide, the portfolio submitted for examination follows the creative arts model that requires candidates to demonstrate a contribution to practice and scholarly understanding, and interestingly, an explication of ‘how well the project was framed and managed and what was learned in the process of undertaking it’ (p. 38). This might involve presentations of creative investigations in suitable formats, as well as a ‘durable record’ of what was produced in a discipline-appropriate form. The durable record is ‘between 20,000 to 40,000 words defining the purpose and theoretical base of the work and the factors taken into account in its conception, development and resolution’ (p. 40). Examination processes for thesis and project are identical.

The University of Western Sydney’s Doctor of Cultural Research targets future professional leaders working at high public sector levels. Embedded in professional practice and structured around staff development, it comprises shorter, focused projects around organizational concerns in workplace settings. Both portfolio and coursework perform as parts of the examination process. The program involves four individual projects accumulating in complexity as the candidate moves through the coursework. All four projects are included in the folio, with each being represented as a written report of 10,000 words and a scholarly article of 7,000 words presented as suitable for publication. The projects are accompanied by a ‘final overarching statement that brings out the relations between projects and overall motivation and sequence of projects’ (August 22, 2007). This represents a highly structured model of a doctoral research portfolio that aims to demonstrate candidates’ learning and doctoral
knowledge production through sustained activity, scholarly research and publication output.

In summary, these three examples represent different ways in which the doctoral research portfolio is already being mainstreamed from the creative arts and professional doctorates into PhD programs. Interestingly, even though form, scope and focus may vary, each program stresses the importance of some form of exegesis, overarching statement, meta-thesis, commentary or dissertation that articulates the relations between the research argument, the various representations and theory or practice, and in some cases, provides an opportunity for candidates to critically reflect on their learning during the doctoral process itself. The next section explores relationships between these elements and discusses emergent issues.

Critical and emergent questions

As we indicated in section two of this paper, there remains a great deal of operational ambiguity surrounding the uptake of portfolios in doctoral education programs in terms of proper resourcing, management and examination processes (Neumann, 2008, in press). Behind this ambiguity lie, we suggest, a number of important epistemological and methodological issues pertaining to the doctoral research portfolio, relating in different ways to debates about changing modes of knowledge production. The purpose of this final section however, is not to resolve or clarify these issues, but to flag them for further discussion. The focus here in particular is on the question of ‘what is doctoral’ in the portfolio and how it can be evidenced?

The process of mainstreaming the doctoral research portfolio from the creative arts and writing fields to broader PhD education raises a number of important issues beyond how its tangible, yet flexible construction may provide ways of presenting a number of doctoral research products in a range of media forms. As we have argued, the primary issue is that of measurement – of the contribution, significance and impact of the research process and its outcomes against international standards, and of the candidate’s capacity to be research-ready and increasingly, employment-ready in a range of possibilities, including academic and peer realms, in the domain itself, and the realm of professional practice. This gives rise to the following questions – how can universities and supervisors use the doctoral research portfolio to develop and measure candidate achievement during the candidature, and how can examiners measure research contribution and impact in this form?

This section will discuss these issues in light of current debates about practice-based doctoral research production in the creative arts/writing fields. These debates centre on the relationship between the primary components of the portfolio (the creative work and the text) how they function together, and how they might be examined holistically as doctoral production. To summarise, of concern in these debates is whether the creative project may evidence ‘doctoral’ in and of itself, without the need for an exegetical text, and how might this be measured as a contribution to the field and/or the professional practice community. Similarly for the doctoral research portfolio, the questions are, what is doctoral, how might this be performed, and how can this be recognised and assessed according to international standards? These questions will be teased out in the following discussion.

First, and as shown in the examples previously discussed in this paper, many portfolios are constructed as a collection of products, whereby the form, structure and content of products varies according to their articulation within degree programs and discipline-specific requirements, accompanied by a reduced version of the traditional dissertation. Clearly, the very flexibility of this structure extends candidates’ capacity to produce a range of doctoral outcomes.
addressing various audiences that evidence research contribution and impact as required, while demonstrating candidates’ research capability. Within the creative arts/writing fields, these include a capacity for creative and material thinking, expressed as ‘Art and design practice-based research involves the application of imaginative thinking through material form at an intersection with theory or philosophy’ (de Freitas 2007, p. 1), as well as capability in IT literacies, and multiple and legitimate forms of research delivery to a variety of discourse communities.

Second, and according to the policy guidelines discussed earlier in this paper, part of what is considered ‘doctoral’ is the candidate’s capacity to assert and communicate the value of their research, the level of which is then assessed by examiners. In this sense, the portfolio has the potential to broaden the significance of the research while increasing its impact through dissemination to academia as discipline-appropriate peer reviewed journal articles, and to professional practice communities in alternative and practice-appropriate forms. Citing Ellis, Kroll suggests that various forms of textual output represent different ‘pieces of language’ (2002, p. 3) in a range of dimensions that are dependent on context, and are to be used in certain ways by certain communities. While highly pragmatic, portfolios provide a suitable platform for different pieces of language that represent graduates’ capabilities as independent research-ready scholars and employment-ready research practitioners. While this appears evident in light of the discussion so far, what is more problematic for candidates, supervisors and examiners is how to articulate and measure coherence between the various products, while at the same time articulating and measuring the value and level of critical and scholarly engagement in the field.

Third, consistently in this survey, all doctoral research portfolios require a reduced form of the traditional dissertation that performs the exegetical function of articulating the coherence of, and relations between, the various representations and the research proposition. Broadly, this text serves the same critical purpose as a PhD dissertation, albeit a shorter version, in its capacity to demonstrate academic rigour and locate the research argument, grounded in the data analysis and supported by a conceptual framework, within the literature. However, within the creative arts and writing fields, there is lively debate about the relations between this text and the artefact, whether a musical composition, performance or creative writing piece. These debates centre on whether the text is a linking paper, a critical and scholarly component that supports the work as it represents the research undertaken, or a creative performance in itself.

Krauth (2002) argues that the main reason the creative PhD has been allowed into the university is because the text functions as the legitimising component of the creative work. He elaborates, explaining that historically in the context of creative writing ‘people have asked for explanations that link written works produced in the culture to the main concerns of the culture…“tell me so I can understand and believe you”, or, “tell me so I can argue with you”’(p. 4). When writers talk about their work, they provide an exposition of the relationship between their writing and the readership in that culture. Thus the text performs the underlying exegetical function of a ‘framing device positioned between the world created in the fiction…and the world the reader inhabits’ (p. 4).

In the context of doctoral research however, Krauth claims that the exegetical text is ‘a part of the main work, but apart from it…as the writer articulates what their research is doing (the creative product) but also what they think the culture thinks about what they are doing (the researched exegesis)’ (p. 5). Further, ‘[e]xegetical writing provides an orientation for the writer, the written
and the read...and provides opportunity for postgraduate writers to ‘speak twice’ (p. 14) about their work.

Arnold (2005) affirms the interrelatedness of text and creative work, conflating the exegesis and artefact as nexus/praxis between artist/scholar in a ‘hybrid thesis [with]...a multi-layered discourse’ (p. 1). However, she questions the legitimising function of the exegetical text, suggesting rather that the relationship between the two is complementary and that each has a different audience. Further, Arnold provides explicit guidelines for examiners of creative doctoral research projects that may be useful in the context of a mainstreamed doctoral research portfolio.

Finally, this brief overview of the debate within creative disciplines flags several questions for further discussion, such as, does the exegesis provide the doctoral candidate an opportunity to concentrate on ‘the activities, the enactments and engagements with creative thinking’ (de Freitas 2006, p. 4) that emphasises the importance of the emergent knowledge and understanding of the creative processes? Or is it a self-conscious chance to argue the value and relative merit of the work in the other representations, to intervene and make the work have meaning (Krauth 2002)? In other words, does the text function as a persuasive explanation of the value of the creative work, or is it to perform alongside the work as part of an integrated whole?

As is the case in doctoral research education generally, the ‘vital issue of value’ (Kroll 1999, p. 2) is problematised within the creative arts fields, and again points to the question of measurement – what constitutes ‘doctoral’? How does the candidate use the doctoral research portfolio to present evidence of the ‘quality’ of their doctoral output, how do supervisors mentor this quality development process, and how do examiners recognise and assess doctoral quality presented in non-traditional forms? While beyond the scope of this paper, in turn, these questions have implications for doctoral education programs and processes, and specifically for universities, how might they evaluate and restructure supervision practices and examination processes to accommodate changing practices in doctoral production and changing forms of doctoral output.

Conclusion

This paper has presented and discussed a number of examples where the doctoral research portfolio has already been mainstreamed into PhD programs because of the flexibility of form it offers candidates to represent modal variations of doctoral output. However, if the doctoral research portfolio continues to expand its reach in doctoral programs in different disciplines, as the evidence suggests it is, it would seem important to debate the question of ‘what is doctoral’, by drawing together current debates in the fields of creative art, writing, design and architecture, as well as in the more mainstream bodies of research into the doctorate, to prompt discussion and co-resourcing between academic disciplines. What is needed as well are rich descriptions of the design and pedagogical practices of portfolio work, to resource the field beyond rhetorical advocacy or technical specification, and perhaps also empirical research into the impact of these more creative forms of doctoral output on the doctoral education experience itself.

References


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The influence of a single semester of 3rd year study on students’ intentions for a postgraduate research degree: What difference does a semester make?

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Abstract
This paper examines the effect of a single semester of third year study on the postgraduate research degree intentions of psychology and non-psychology students enrolled in a third year Behaviour in Organisations university course at a research intensive university. The students responded to a survey about future research study intentions at the beginning and again at the end of first semester, producing 60 useable responses. Results indicate that only slight changes occurred in students’ intentions to embark on postgraduate research degree study over the course of a single third year semester. Students neither changed their preferences for the type of Masters course in which they intended to enrol, nor did they change the degree to which they intended to study either a combined Masters/PhD or research-only PhD degree. The implications for academics who are seeking postgraduate research students are discussed.

Introduction
Postgraduate research students are increasingly the focus of academic research. Investigations have addressed the:

- personality and other differences of the postgraduate research student (Carter, Carre, & Bennett, 1993; Humphrey & McCarthy, 1999; Johnson, Lee, & Green, 2000)
- dissonance experienced by the postgraduate student (Wisker, Robinson, Trafford, Creighton, & Warnes, 2003)
- learning styles preferences of postgraduate research students (Haggis, 2002; Klein, McCall, Austin, & Piterman, 2007; Smits et al., 2004; Wu, Griffiths, Wisker, Waller, & Illies, 2001)
- completion rates differences between postgraduate research students of (Wright & Cochrane, 2000)
- teaching of the postgraduate program (Breen & Lindsay, 1999; Chapman & Pyvis, 2005; Lindsay, Breen, & Jenkins, 2002; McMichael, 1993; Motteram, 2006; Pearson & Brew, 2002)
- university environment and research experience (Barrett & Lally, 2000; Deem & Brehony, 2000; Delamont, Atkinson, & Parry, 1997; McCormack, 2004; Neumann, 1992, 2003; Roff & McAleer, 2001)

But a postgraduate research degree student was not always a postgraduate research degree student. The decision to embark on a postgraduate degree may be made before the start of a student's undergraduate career, during the undergraduate degree, towards the end of the undergraduate degree, or some period of time after the student has graduated. Little appears to have been written about the antecedents to the decision to become a postgraduate...
research student. While we have a great deal of information about those who do proceed to a postgraduate research degree, with the exception of very limited study of honours (see for example, AVCC, 1995; Schatz, Boroujerdi, & Deth, 1987; Shaw and Holbrook, 2006) the current literature does not tell us how or when those decisions are made or influenced. The majority of literature on postgraduate research students' characteristics and decision-making is post-hoc, after the student has enrolled in a postgraduate research degree (see, for example Neumann, 2003). The respondents in such studies are, rightly and appropriately, the students who went on to become postgraduate research students. There is a scarcity of research, however on the antecedents to the postgraduate study decision. The current study seeks to initiate research in this domain by investigating the postgraduate research intentions of students while the students are still enrolled as undergraduate students.

Multiple factors are likely to influence students in many major decisions, such as workforce destination, over the course of their undergraduate degree. It would be reasonable to expect that the passage of time during the undergraduate degree would have a strong influence on some students' intentions to progress to a postgraduate research degree. The lectures, discussions with academics, tutors, and fellow students, the subject matter and tutorial topic materials and other influences of any semester could be expected to influence students in their work and study destinations. The research question posed in this study investigates the influence of the passage of time — one semester — on the postgraduate research intentions of one cohort of students in one discipline. Given the number of postgraduate students who anecdotally suggest they did not on postgraduate study when they commenced their undergraduate degree, we might assume that students form many of their intentions to progress to a postgraduate degree during the course of their undergraduate degree. At any time throughout a degree, students would be expected to have more or less of an intention to continue toward a postgraduate research degree.

Psychology is an example of a discipline with an expanding postgraduate research student base (Hyslop & Cumming, 1998). The NSW Psychologists Registration Board requires a minimum of four years approved psychology study followed by either a two year supervision or Masters program in order to become registered as a psychologist. The Australian Psychology Society (APS), the professional body for psychologists, has since 2000 required a minimum of six years psychology study — the four year undergraduate psychology study plus two years of an approved Masters — to progress to membership of the professional body. The APS no longer recognises the supervision program as qualifying for professional membership. A psychologist may be recognised by the Registration Board and yet not be eligible for membership of the professional body for psychologists. Similar registration exists throughout the Australian states and territories and a national registration system is to be introduced in 2008. Australian registration requirements are consistent with an international trend to require increased, rather than decreased tertiary education to be registered and to practice as a psychologist.

Because the minimum psychology degree is promoted as four years, many undergraduate psychology students, whether enrolled directly in a psychology program or enrolled in arts or science degrees, could be expected to complete the fourth, honours, year if they wish to keep their future psychology options open. Additionally, a proportion of undergraduate psychology students would be expected to follow the honours year with a Masters degree as the preferred method to become a registered psychologist. The APS requirements for the Masters degree includes coursework, a research thesis and 1,000 hours of supervised professional placement.
In contrast, a PhD is research-only and would be expected to take three years full time. Because the PhD includes neither prescribed coursework nor supervised placement, a PhD is not recognised by either the Psychologists Registration Board or the APS as direct entry as a psychologist. An Honours psychology student seeking an option for an academic career might be attracted to a PhD but the majority of Honours psychology students could be expected to prefer the registration and professional recognition afforded by the Masters program. Academically gifted and ambitious students could be expected to aim for a combined Masters/PhD degree. The combined degree at most universities where it is offered is heavily restricted to perhaps one or two students per year. The combined degree is frequently not offered where students are not regarded as having capacity to complete both degrees. A small number of Australian universities also offer a DPsych, a professional doctorate with a research thesis, extended course work and professional hours that satisfies registration requirements.

In summary, then, a third year psychology student has a number of academic options. A student could finish their studies after the third year or where they meet the minimum academic prerequisites, do a fourth or honours year, or at universities that offer the postgraduate psychology courses, a Masters, PhD, combined Masters/PhD, or a professional doctorate degree. This study focuses on those undergraduate psychology students and their progression choices. The study seeks to understand the degree to which students in their third year of undergraduate psychology study change their intentions for postgraduate research study during the course of a single semester.

Method

Subjects

Subjects were psychology students at a large city research intensive university. The research took place during the first semester of the third year of study. The course was Behaviour in Organisations, which is taught by faculty from the organisational psychology program. There were two lecturers in the course and two tutors. Both lecturers had completed both Masters and PhDs and the tutors were two combined Masters/PhD students. The lecturers were keen to promote postgraduate research study in undergraduate students. The lecturers announced during their lectures, on two occasions each, their areas of research interest. The lecturers emphasised they would be keen to see students from that third year course progress to masters or PhD level research.

Materials

Students were asked to complete a study destinations questionnaire, indicating the degree to which they agreed they were likely to progress to each of the possible study options. The questionnaire was designed for this research and included the following items to determine the degree to which a student intends progressing to further study:

1. I intend studying a psychology honours program
2. I intend studying a psychology masters program
3. I intend studying a combined masters/PhD program
4. I intend studying a PhD program.

The following items were developed to determine the type of masters degree that students are most attracted to:

1. I intend studying a Masters of Clinical Psychology program (or Masters/PhD)
2. I intend studying a Masters of Counselling Psychology program (or Masters/PhD)

3. I intend studying a Masters of Forensic Psychology program (or Masters/PhD)

4. I intend studying a Masters of Organisational Psychology program (or Masters/PhD).

This design was chosen over a forced choice design where respondents would be asked to 'select which of the following are most likely for you' because it was expected that some students would still be unclear about their study destination preferences in their 3rd year. This questionnaire design enabled students to indicate their degree of intention as a study destination for more than one preference simultaneously.

The following wording preceded the items: ‘Although you may not yet have decided on what you will do at the end of this academic year, we are curious to know your current thoughts on the possibilities of continuing study, and in particular, any higher study in psychology. That could be immediately or a few years after finishing your current degree. Indeed, some students are already enrolled in an honours degree. On the other hand, some students see the study of psychology as a small part of another degree program and career.’

Respondents were asked to rate their agreement with each item using a five point Likert scale from 1 = strongly agree to 5 = strongly disagree.

Institutional ethics approval which would enable tracking of student opinions was obtained. Student confidentiality and anonymity in the research analysis and publication was ensured and students were free to opt out of the study without consequence at any stage. Participation in the study was not a requirement of the course.

A questionnaire was distributed during week two of the semester to those students who agreed to participate as volunteers in the research. The Time 1 questionnaires were completed outside class time and returned the following week. An identical Time 2 questionnaire was distributed in week 11 of the semester and completed during tutorial classes.

The intervention designed for the study was an informal and unscripted appeal by both lecturers for students to consider progressing beyond a fourth year, to a masters, PhD or the combined degree. Lecturer One made appeals during a lecture in weeks 3 and 6, while Lecturer Two made appeals in weeks 8 and 11. At all times, lecturers demonstrated enthusiasm for students to progress to postgraduate research study. The intervention could be considered typical of the type of informal encouragement normal in third year courses in many disciplines within universities.

**Results**

There were 100 students enrolled in the subject, of whom 96 responded at Time 1 and 70 responded at Time 2. Most students supplied their student number on both occasions, enabling any changes in their responses to be tracked over the semester. After removing responses with missing data, there were 60 students who responded to both Time 1 and Time 2 surveys who included their student number on both occasions. The responses comprised 43 (72%) female and 17 (28%) male respondents. Respondents came from a range of cultural backgrounds with 33 (55%) respondents born in Australia, 27 (45%) respondents who speak only English at home and 20 (33%) respondents who speak Chinese at home. There were 44 (73%) respondents who were psychology or science students, while 16 (27%) of the respondents were from non-psychology programs such as arts, economics or commerce degrees.
Descriptive statistics for both the progression intention and masters choice items are given in Table 1.

### Table 1: Item descriptives

<table>
<thead>
<tr>
<th>Item</th>
<th>N</th>
<th>Mean (S.E.)</th>
<th>Std. Deviation</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Progression items</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Honours</td>
<td>60</td>
<td>2.73 (.206)</td>
<td>1.593</td>
<td>2.538</td>
</tr>
<tr>
<td>T2 Honours</td>
<td>60</td>
<td>2.72 (.193)</td>
<td>1.497</td>
<td>2.240</td>
</tr>
<tr>
<td>T1 Any Mstrs</td>
<td>60</td>
<td>2.98 (.189)</td>
<td>1.467</td>
<td>2.152</td>
</tr>
<tr>
<td>T2 Any Mstrs</td>
<td>60</td>
<td>3.03 (.176)</td>
<td>1.365</td>
<td>1.863</td>
</tr>
<tr>
<td>T1 Mstr/PhD</td>
<td>60</td>
<td>3.43 (.141)</td>
<td>1.095</td>
<td>1.199</td>
</tr>
<tr>
<td>T2 Mstr/PhD</td>
<td>60</td>
<td>3.57 (.139)</td>
<td>1.079</td>
<td>1.165</td>
</tr>
<tr>
<td>T1 PhD</td>
<td>59</td>
<td>3.64 (.151)</td>
<td>1.156</td>
<td>1.337</td>
</tr>
<tr>
<td>T2 PhD</td>
<td>60</td>
<td>3.62 (.135)</td>
<td>1.043</td>
<td>1.088</td>
</tr>
<tr>
<td><strong>Masters choice items</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Clinical</td>
<td>60</td>
<td>3.72 (.147)</td>
<td>1.136</td>
<td>1.291</td>
</tr>
<tr>
<td>T2 Clinical</td>
<td>60</td>
<td>3.85 (.136)</td>
<td>1.055</td>
<td>1.113</td>
</tr>
<tr>
<td>T1 Counselling</td>
<td>60</td>
<td>3.68 (.131)</td>
<td>1.017</td>
<td>1.034</td>
</tr>
<tr>
<td>T2 Counselling</td>
<td>60</td>
<td>3.92 (.120)</td>
<td>.926</td>
<td>.857</td>
</tr>
<tr>
<td>T1 Forensic</td>
<td>60</td>
<td>4.00 (.111)</td>
<td>.864</td>
<td>.746</td>
</tr>
<tr>
<td>T2 Forensic</td>
<td>60</td>
<td>4.17 (.089)</td>
<td>.693</td>
<td>.480</td>
</tr>
<tr>
<td>T1 Organisational</td>
<td>60</td>
<td>3.00 (.170)</td>
<td>1.315</td>
<td>1.729</td>
</tr>
<tr>
<td>T2 Organisational</td>
<td>60</td>
<td>3.23 (.147)</td>
<td>1.140</td>
<td>1.301</td>
</tr>
</tbody>
</table>

At Time 1, the most popular of the progression intention items was the honours program (2.73), followed by any masters program (2.98) then the combined masters/PhD program (3.43) and least popular of the progression intention items was the PhD (at 3.64).

**Figure 1: Progression intention items at Time 1 (n = 60)** (Note: Higher means indicate less agreement)

Reliability for the scales was established with the four progression items – intention to continue to honours, any masters, the combined Masters/PhD
Quality in Postgraduate Research

program and the PhD program – generating a Cronbach’s alpha of .87 at Time 1 and .88 at Time 2.

As can be seen from Figure 2, the clinical, counselling and forensic masters programs shared about equal popularity with means of 3.72, 3.68 and 4.00 respectively while the organisational psychology masters program was the most popular with a mean of 3.00.

Figure 2: Masters choices items at Time 1 (n = 60) (Note: Higher means indicate less agreement)

The masters choices scale comprising the clinical, counselling, forensic and organisational options generated alphas of .73 at Time 1 and .79 at Time 2. Descriptives, correlations and Cronbach’s alphas for both the progression intention scales and the masters choices scales are given in Table 2.

Table 2: Scale descriptives, correlations and Cronbach alphas

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. T1 Progression</td>
<td>3.20</td>
<td>1.14</td>
<td>60</td>
<td></td>
<td>(.87)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. T2 Progression</td>
<td>3.23</td>
<td>1.08</td>
<td>60</td>
<td></td>
<td>.790(***)</td>
<td>(.88)</td>
<td></td>
</tr>
<tr>
<td>3. T1 MstsChs</td>
<td>3.60</td>
<td>0.81</td>
<td>60</td>
<td>.751(**)</td>
<td>.699(**)</td>
<td>(.73)</td>
<td></td>
</tr>
<tr>
<td>4. T2 MstsChs</td>
<td>3.79</td>
<td>0.76</td>
<td>60</td>
<td>.624(**)</td>
<td>.806(**)</td>
<td>.739(**)</td>
<td>(.79)</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

To determine the degree to which students changed their intention to progress to further studies over the period of a single semester, paired samples t-tests were conducted on the progression intention items. Time 1 responses were paired with Time 2 responses to the same item (see Table 3).

To determine the degree to which students changed their preference for particular masters programs over the single semester, paired samples t-tests were conducted on the masters choices items. Time 1 responses were again paired with Time 2 responses to the same item (see Table 3).
Table 3: Scale changes over semester using paired sample test

<table>
<thead>
<tr>
<th>T1-T2 Paired differences</th>
<th>Mean</th>
<th>SD</th>
<th>Std Error Mean</th>
<th>95% confidence interval of the difference</th>
<th>t</th>
<th>Df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Upper</td>
<td>Lower</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Progression intentions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 1 Honours</td>
<td>.017</td>
<td>1.01</td>
<td>.131</td>
<td>-.246</td>
<td>.279</td>
<td>.127</td>
<td>59</td>
</tr>
<tr>
<td>Pair 2 Mstrs</td>
<td>-.050</td>
<td>.964</td>
<td>.124</td>
<td>-.299</td>
<td>.199</td>
<td>-.402</td>
<td>59</td>
</tr>
<tr>
<td>Pair 3 Mstr/PhD</td>
<td>-.133</td>
<td>.999</td>
<td>.129</td>
<td>-.392</td>
<td>.125</td>
<td>-1.033</td>
<td>59</td>
</tr>
<tr>
<td>Pair 4 PhD</td>
<td>.000</td>
<td>1.01</td>
<td>.132</td>
<td>-.265</td>
<td>.265</td>
<td>.000</td>
<td>58</td>
</tr>
<tr>
<td><strong>Masters choices</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pair 5 Clinical</td>
<td>-.13</td>
<td>0.95</td>
<td>0.12</td>
<td>-.38</td>
<td>0.11</td>
<td>-1.09</td>
<td>59</td>
</tr>
<tr>
<td>Pair 6 Counselling</td>
<td>-.23</td>
<td>0.89</td>
<td>0.11</td>
<td>-.46</td>
<td>0.00</td>
<td>-2.03</td>
<td>59</td>
</tr>
<tr>
<td>Pair 7 Forensic</td>
<td>-.17</td>
<td>0.69</td>
<td>0.09</td>
<td>-.35</td>
<td>0.01</td>
<td>-1.86</td>
<td>59</td>
</tr>
<tr>
<td>Pair 8 Org</td>
<td>-.23</td>
<td>0.85</td>
<td>0.11</td>
<td>-.45</td>
<td>-0.01</td>
<td>-2.12</td>
<td>59</td>
</tr>
</tbody>
</table>

When the differences between Time 1 and Time 2 progression intention responses were compared, t-tests revealed that none of the changes in progression intentions were statistically significant. When the differences between Time 1 and Time 2 masters choices responses were compared, t-tests revealed that students changed their responses to the counselling (3.68 at Time 1 and 3.92 at Time 2) and organisational (3.00 at Time 1 to 3.23 at Time 2) psychology masters programs to a statistically significant degree (see Table 3). It would appear that the changes in the responses from Time 1 to Time 2 for those items are not due to chance but to intervening factors.

**Discussion**

The results provide insight into how students are planning their academic progress and which postgraduate degree courses are being considered by students. The most popular intended study destination for respondents at Time 1 was to proceed to honours degree (2.73) with less intention to study the masters (2.98), combined degree (2.43) or pure PhD (2.64) progressively. The same pattern was evident at Time 2. With the exception of the PhD, the increasing time commitment required by each degree appears to act as a deterrent to student intentions and the results are therefore not surprising. It is important to note, however, that the combined masters degree, although longer than the straight PhD, is more popular that the shorter PhD. The higher popularity of the combined degree may be due to the psychologist registration enabled by the masters but not available via the PhD degree.

The study found that a single semester had no influence on these students’ intentions to progress towards a PhD. There was no change in students’ intention to study a PhD as that progression intention maintained the same degree of popularity from Time 1 (3.64) to Time 2 (3.62). It would seem that a single semester that includes four lecturer appeals to consider a masters or PhD program does not at all influence a student’s intention to progress to a PhD at this stage in their undergraduate degree. It may of course be that for those students who do finally progress to a fourth honours year that the decision making influences are different.
Of the masters degrees available to the students, the most popular program at the start and again at the end of the semester was the organisational program. This is not surprising, given the organisational psychology nature of the course the students were studying. The least popular of the masters programs for this group of students was the forensic masters degree at both Time 1 and Time 2. The relationship of organisational psychology as most popular and forensic psychology as least popular was maintained at both Time 1 and Time 2.

Further analyses were conducted on the items to determine the difference between the students’ intended study destination at Time 1 and their intended study destination at Time 2. While counselling psychology was slightly more popular than clinical psychology at Time 1, the order of that slight difference was reversed by Time 2 when clinical psychology was slightly more popular than counselling psychology. Other than that change, the relative order of all options was maintained from Time 1 to Time 2. In addition, the level of intention of students’ study destinations was mostly maintained from Time 1 to Time 2.

There were some statistically significant exceptions. The counselling psychology masters course became less popular from Time 1 (3.68) to Time 2 (3.92). In a surprising result given the nature of the intervention designed for the study, the organisational psychology masters course was also less popular at Time 2 (3.23) than at Time 1 (3.00). There were no progression intentions or masters programs that showed a statistically significant increase in popularity from Time 1 to Time 2. While it is tempting to speculate on the reasons for the direction or extent of the changes in popularity of the courses, the small sample size of the study prohibits such conjecture.

The importance of the honours year for future research intentions may be worth investigating to a greater extent. For example, Neumann (2003) and Neumann and Boucher (2004,2005,2006, 2007) show that many commencing research masters and doctoral students say that they were influenced by their honours year research experience or their honours supervisor to continue with postgraduate research. Further, Neumann (2003) found that a well established honours program in research intensive departments and faculties was important for the recruitment of doctoral students from within their own undergraduate population. The high reputation of the established university in the current study may have already attracted as undergraduates those students who intend to progress to a postgraduate research degree. Perhaps the vagaries of a single semester are not enough to influence, let alone persuade an undergraduate student to progress if they have not already strongly considered postgraduate study as a possibility. On the other hand, it may be that in psychology, the destination intention may be clarified in the honours year rather than the third year.

The results of the study have implications for academics who are keen to recruit postgraduate research students. It would appear from these results that the lecturers’ moderate but enthusiastic references during lectures to postgraduate research program study had little effect on the students, and may even have reduced the students’ intentions to progress to counselling and the organisational psychology masters degrees programs. Clearly, the expected result of increasing students’ intentions to progress to postgraduate study, whether coursework or by research, was not successful in this study. Academics who are keen to attract postgraduate research students might continue to consider alternative traditional methods of recruiting postgraduate research students. Those methods would normally include directly approaching the top scoring or keen students, asking for referrals from other academics and responding to direct student queries for supervision. Further, departments and faculties keen on increasing their research student population may wish to adopt a more formal, considered approach to future recruitment. The results of
the current study suggest that individual academics who hint or gently suggest during an undergraduate lecture that postgraduate research is a viable option for students are not likely to significantly influence their students to consider a postgraduate research degree. It does not appear that moderate references to postgraduate research programs influence students to progress towards those degrees.

This study has limitations to be highlighted. First, the respondents were from a single cohort of psychology students selected due to their choice of a single organisational psychology subject, so generalisation of the results would be improved if a wider range of psychology students were recruited or if different disciplines had participated in the study. Second, respondents were attending and therefore influenced by a range of lectures, tutorials, work and social experiences throughout the semester – none of which were captured or controlled for in the current study. It is possible that the students were dissuaded, rather than persuaded, to progress to postgraduate research study by the lecturers or their tutors. A wider study that controlled for the lecturing and tutoring personnel could overcome that limit. Third, the manner of the questionnaire may be improved by forcing students to choose a single preference at each of Time 1 and Time 2.

The study raises issues for future research. Given the use of student identification numbers in this research, it may be possible to continue this research to track decision making as the student respondents progress through to postgraduate research degree choice. The relationship between the level of the respondent students’ success at their studies may be a factor that could be determined when student assessment results are available. Given the nature of the four year psychology degree, it is likely to be informative also to see the results of the study repeated during the fourth or honours year for this cohort. The study inspires, we hope, the further investigation of how and when undergraduate psychology and students from other disciplines form and make their decisions to progress to a postgraduate degree.

References


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Authorship dilemmas for Research Higher Degree students

Suzanne Morris
University of Queensland, Australia

Introduction

The research conducted by Research Higher Degree (RHD) students forms a vital part of an institution’s overall research effort. Students are generally encouraged to publish their research results and like their academic counterparts, often find it challenging to determine authorship and author order on their publications. The stakes are high. A successful, internationally recognised research career, particularly in academia, is heavily biased to publication quality, number and the order of authors on those publications. This paper will explore, through the eyes of postgraduate student Chris, some of the authorship dilemmas faced by students who publish their thesis research. Chris’ dilemma is real. The questions and answers reported herein are taken from a short questionnaire that was administered to 13 postgraduate students in the biological sciences.

Chris’ journey

Chris: Hello, my name is Chris and I’m a PhD student at the University of GoodResearch, Australia, in my third (and hopefully final) year of candidature. I’m researching consumer attitudes to agriculture and farming practices under the supervision of Prof Jenny and Dr Phil. I currently receive a university living allowance stipend and my research costs are covered by an Australian Research Council (ARC) grant obtained by my supervisors. I completed my undergraduate degree at another Australian university and came to work with Prof Jenny after I saw her give an outstanding conference presentation on her research.

In the second year of my candidature, I conducted a survey of 150 people at a Tasmanian organic farming field day to gauge consumer attitudes to organic farming. I developed many of my survey questions based on qualitative data published in one of Phil and Jenny’s previous papers, and the remainder of the questions from other research conducted in the area. Prof Jenny and Dr Phil only made a few typographical corrections to the survey. In my third year of candidature I finished analysing my survey results. The results revealed some interesting observations as to why consumers purchase organic vegetables so I decided to write a paper on my findings and submit it for publication. I was very excited by the prospect of seeing my name and research results in print. I emailed my draft manuscript to Prof Jenny and Dr Phil for their approval and at the top of the manuscript listed my name as the sole author.

Prof Jenny wrote back demanding that she and Phil also be authors on the paper as they had secured the original grant that funded the research. Prof Jenny also demanded that the order of authors on the paper be Chris, Phil, Jenny. Dr Phil replied to my original email providing comment only on the manuscript content (with a few grammatical and typographical changes) and nothing on the author status of the paper. I was stunned by Prof Jenny’s demands. After all, I had done the research planning, execution and analysis, and had written the manuscript. But I needed Prof Jenny and Dr Phil’s support and guidance to get me through my thesis examination and be referees for future jobs. What should I do? This is my dilemma.
When the anger and hurt subsided, I realised I knew nothing about authorship and had many unanswered questions: What did it mean to be an author? How was authorship usually determined in my discipline and by my supervisors? Were there any university rules or policies that could back up my case for sole authorship? Why didn’t they tell me about this at my new student induction.

To help me answer these questions, I asked 13 of my fellow students (five males, eight females) from the biological sciences how authorship was determined on publications arising from their thesis research. I asked them to complete the following questionnaire (Table 1):

Table 1. Authorship questionnaire administered to 13 students

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In publications arising from your student/supervisor collaboration, i.e., thesis research, or past collaborations, please briefly describe how you decided what contributions warranted authorship?</td>
<td></td>
</tr>
<tr>
<td>2. In publications arising from your student/supervisor collaboration, i.e., thesis research, or past collaborations, please briefly describe how you decided on the order of authors?</td>
<td></td>
</tr>
<tr>
<td>3. At the start of your candidature, did you discuss authorship with your supervisor/s?</td>
<td>Yes ☐ No ☐ (please go to Question 5) Unsere (please go to Question 5)</td>
</tr>
<tr>
<td>4. If yes, did you discuss:</td>
<td></td>
</tr>
<tr>
<td>a) what contributions warranted authorship?</td>
<td>Yes ☐ No ☐ Unsure</td>
</tr>
<tr>
<td>b) how to decide the order of authors on the manuscript?</td>
<td>Yes ☐ No ☐ Unsure</td>
</tr>
<tr>
<td>5. Have you ever experienced (directly or indirectly) issues related to publication when:</td>
<td></td>
</tr>
<tr>
<td>a) deciding who should be an author on a manuscript?</td>
<td>Yes ☐ No ☐ Unsure</td>
</tr>
<tr>
<td>b) deciding the order of authors on a manuscript?</td>
<td>Yes ☐ No ☐ Unsure</td>
</tr>
</tbody>
</table>

I grouped the responses from Questions 1 and 2 into themes and calculated the average responses to Questions 3, 4 and 5 as a percentage.

Ten themes were identified among the responses to Questions 1 and 2. When asked about what contributions warranted authorship in their current or past collaborations (Question 1), the three most prevalent themes identified were ‘work done’, ‘conducted writing’, and ‘research design’ (Figure 1). The only two themes my contribution to this current paper didn’t address were ‘obtained funding’ or ‘supervisor/group leader’, but as a student, it would be rare for me to have obtained funding for my thesis research. Some of my colleagues responded to this question as follows:

Those who have contributed to design, execution, analysis and writing for the manuscript. (Female PhD student)
Whoever did/does the research and writing of the manuscript and also
whoever received the grant for the research and/or contributed to the
project significantly. (Female PhD student)

I didn't really decide - was left to other people. (Female PhD student)

When asked about how author order was determined, the four most common
themes identified in the responses were ‘conducted writing’, ‘first/last author’,
‘supervisor/group leader’, and ‘work done’ (Question 2, Figure 1). Again, the
only two themes my contribution to this current paper didn’t address were
‘obtained funding’ or ‘supervisor/group leader’, and perhaps the concept of
‘first/last author’ as I was the only author on this paper. Three colleagues
responded to this question as follows:

The first author is the one doing most of the experiments and writing. The
last one is the main lab leader. (Female PhD student)

Main author is listed first, and the supervising author is listed last. Any other
contributors are listed in between, in order of contribution. (Male PhD
student)

For my Honours, my supervisor encouraged me to put myself as 1st author
but I didn’t realise the significance at the time so put myself as 2nd author.
For my current studies (PhD), my supervisor believes I should write the
manuscripts and be 1st author and all other supervisors come after me.
(Female PhD student)

The last quote shown above for each question is particularly concerning. It’s
clear from their responses that these students have underestimated the
importance of publications. I thought that first author publications from your
PhD research were essential for obtaining a ‘good’ research job in academia or
industry.

**Figure 1. Prevalence of themes identified in Question 1 and 2
responses.**

<table>
<thead>
<tr>
<th>Question 1 themes</th>
<th>Question 2 themes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Most prevalent</strong></td>
<td></td>
</tr>
<tr>
<td>work done</td>
<td>conducted writing</td>
</tr>
<tr>
<td>conducted writing</td>
<td>first/last author</td>
</tr>
<tr>
<td>research design</td>
<td>supervisor/group leader</td>
</tr>
<tr>
<td>conducted analysis</td>
<td>work done</td>
</tr>
<tr>
<td>obtained funding</td>
<td>time spent</td>
</tr>
<tr>
<td>supervisor/group leader</td>
<td>developed ideas</td>
</tr>
<tr>
<td>time spent</td>
<td>discussed/negotiated</td>
</tr>
<tr>
<td>developed ideas</td>
<td>obtained funding</td>
</tr>
<tr>
<td><strong>Least prevalent</strong></td>
<td></td>
</tr>
<tr>
<td>discussed/negotiated</td>
<td>research design</td>
</tr>
</tbody>
</table>
Next I explored the responses to the closed questions. Almost 70% of the respondents had not discussed authorship with their supervisors at the beginning of their candidature (Table 2). I also had never discussed authorship or even the notion of producing publications with Prof Jenny and Dr Phil when I started my PhD. Of the three people who did discuss authorship with their supervisors, two of them also discussed what contributions warranted authorship and all discussed how to determine the order of authors on future publications (Questions 4a and 4b, Table 2). One third of the respondents to Question 5 had witnessed issues related to authorship and author order, either directly or indirectly. I could now add myself to that list too.

**Table 2. Average responses to Questions 3, 4 and 5.**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Discussed authorship with your supervisor</td>
<td>23.1</td>
<td>69.2</td>
<td>7.69</td>
<td>13</td>
</tr>
<tr>
<td>4a. Discussed what contributions warranted authorship</td>
<td>66.7</td>
<td>33.3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4b. Discussed order of authors on the manuscript</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5a. Experienced issues related to authorship</td>
<td>33.3</td>
<td>66.7</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>5b. Experienced issues related to order of authors</td>
<td>33.4</td>
<td>58.3</td>
<td>8.3</td>
<td>12</td>
</tr>
</tbody>
</table>

Armed with more ideas about authorship from my fellow students, I reviewed the literature for what was known about authorship and what was considered to be ‘best practice’. First stop was the library where I searched for books on doing a PhD and supervising PhD students. The first book I came across was *Eleven Practices of Effective Postgraduate Research Supervisors* (James & Baldwin, 2006). In the section which discussed publishing research, there was a little box on co-authorship:

*Disciplines have their own conventions about authorship of publications. Often it is entirely appropriate for supervisors to be co-authors of publications derived from research students’ projects. Authorship of such papers should be discussed early in the project with the aim of determining an agreement that is fair to all. Co-authorship should be determined on the basis of each person’s initiative and involvement in collecting information, analysing it, planning the publication, and, of course, in the actual writing. However, since the origins of core ideas are difficult to determine, a ‘formula’ for authorship is unlikely to work well and can be no substitute for discussion and negotiation. (James & Baldwin, 2006, p. 43)*

Prof Jenny and Dr Phil should definitely read this book. Had they read it and followed its suggestions verbatim, we would have discussed authorship at the
beginning of my candidature or very soon after, and this authorship problem could have been averted. I too would have found this advice useful if I’d read it before sending my draft manuscript to Prof Jenny and Dr Phil, but what do I do now to solve my authorship dilemma?

I grabbed the next book off the shelf, hoping to find some advice that I could use now. The book was called Getting a PhD: An action plan to help manage your research, your supervisors and your project (Finn, 2005) and it contained a whole section on authorship.

The important point is that you need to discuss and agree the issue of authorship with your supervisors (and other potential co-authors) well in advance of producing a manuscript. Unfortunately, deciding on authorship can sometimes be awkward and occasionally controversial; when this occurs, disputes about authorship can be extremely divisive. (Finn, 2005, p. 141).

Divisive you’re telling me... Like the advice in the first book, this information would have been useful to know at the beginning of my candidature. I’m sure my other colleagues who also didn’t discuss authorship with their supervisors at the beginning of their candidature would be keen to know this information. I read on, hoping to find something useful in the three pages devoted to authorship. I came across Box 6.1, ‘Further guidelines on authorship of journal publications’ (Finn, 2005, p. 142), which described something called the ‘Vancouver Protocol’. The ‘Vancouver Protocol’ was developed by the International Committee of Medical Journal Editors (ICMJE) and establishes a set of guidelines for manuscripts submitted to many biomedical journals. The ‘Vancouver Protocol’ provides the following minimum requirements for authorship:

- **Authorship credit should be based on:**
  1. substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data;
  2. drafting the article or revising it critically for important intellectual content; and
  3. final approval of the version to be published. Authors should meet conditions 1, 2, and 3.

- **Acquisition of funding, collection of data, or general supervision of the research group, alone, does not justify authorship.**

- **All persons designated as authors should qualify for authorship, and all those who qualify should be listed.**

- **Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content.**

- **Increasingly, authorship of multi-centre trials is attributed to a group. All members of the group who are named as authors should fully meet the above criteria for authorship.**

- **The order of authorship on the by-line should be a joint decision of the co-authors. Authors should be prepared to explain the order in which authors are listed. (ICMJE, 2006)**
Finally, some advice I could use now. Not only did this ‘Vancouver Protocol’ describe what you need to have done to be an author, but it also emphasised that ‘Acquisition of funding... or general supervision of the research group, alone, does not justify authorship.’ (ICMJE, 2006). This Protocol was definitely something I could talk with Prof Jenny and Dr Phil about. After all, it was widely accepted in the medical and biomedical fields and probably was also endorsed by other disciplines. My fellow students ranked ‘work done’, ‘conducted writing’ and ‘research design’ as the three most important themes when asked what contributions warranted authorship in their current or past collaborations (Figure 1). It’s good to know that these themes are important aspects of the ‘Vancouver Protocol’. A few students also thought that ‘obtained funding’ was an important criterion for determining authorship and author order. I should inform these students that according to the Protocol, acquisition of funding alone does not warrant authorship.

The third book I found in the library was Supervising Doctorates Downunder: Keys to effective supervision in Australia and New Zealand (Denholm & Evans, 2007). In the section devoted to authorship, there was no mention of the ‘Vancouver Protocol’, but rather something called the Joint NHMRC/AVCC Statement and Guidelines on Research Practice (1997). The book mentioned that the Guidelines were under review at the time the book was published, so I ‘Googled’ these terms and came up with the new statement entitled Revision of the Joint NHMRC/AVCC Statement and Guidelines on Research Practice: Australian code for the responsible conduct of research (National Health and Medical Research Council, the Australian Research Council and Universities Australia, 2007). Section 5 of these guidelines is entitled ‘Authorship’.

To be named as an author, a researcher must have made a substantial scholarly contribution to the work and be able to take responsibility for at least that part of the work they contributed.

Attribution of authorship depends to some extent on the discipline, but in all cases, authorship must be based on substantial contributions in a combination of:

- conception and design of the project
- analysis and interpretation of research data
- drafting significant parts of the work or critically revising it so as to contribute to the interpretation.

The right to authorship is not tied to position or profession and does not depend on whether the contribution was paid for or voluntary. It is not enough to have provided materials or routine technical support, or to have made the measurements on which the publication is based. Substantial intellectual involvement is required.

Section 5.1 of the Guidelines states that ‘Institutions must have a policy on the criteria for authorship consistent with this Code, seeking to minimise disputes about authorship and helping to resolve them if they arise.’, while Section 5.5 says that authorship does not include ‘providing routine assistance in some aspects of the project, the acquisition of funding or general supervision of the research team’ and ‘providing data that has already been published... but with no other intellectual input.’ (National Health and Medical Research Council, the Australian Research Council and Universities Australia, 2007). The evidence in my favour was mounting. Here was a document that outlined the criteria for authorship and this Code was something that the University of GoodResearch
was supposed to abide by. I wonder if the University of GoodResearch even has a policy on authorship.

The University policy website was my next stop where I found a policy on authorship very similar to the Revision of the Joint NHMRC/AVCC Statement and Guidelines on Research Practice: Australian code for the responsible conduct of research (National Health and Medical Research Council, the Australian Research Council and Universities Australia, 2007), herein termed NHMRC/ARC/UA Guidelines. This was promising. I wonder if Prof Jenny and Dr Phil are aware of this University policy. If they are, surely Prof Jenny wouldn’t be demanding authorship on a paper when she (and Dr Phil) didn’t meet the criteria?

I now had sufficient evidence to confront Prof Jenny and Dr Phil about my paper. But perhaps I shouldn’t view it as a confrontation as all the books I’d read encouraged ‘discussion’ among potential co-authors. I called a meeting with Prof Jenny and Dr Phil to discuss my paper but before we met, I spent some time developing my case. In light of the ‘Vancouver Protocol’, NHMRC/ARC/UA Guidelines, and University of GoodResearch policy, I believe that I should be the only author on this paper because:

1. I alone designed and executed the survey that measured consumer attitudes to organic farming, analysed the data and wrote the manuscript (Dr Phil only made grammatical and typographical changes to the draft manuscript). These are the authorship criteria as outlined by the ‘Vancouver Protocol’, NHMRC/ARC/UA Guidelines, and University of GoodResearch authorship policy.

2. Prof Jenny and Dr Phil secured an ARC grant to conduct this research. This is the sole reason that Prof Jenny gave for her and Dr Phil to be included as authors on my paper. The ‘Vancouver Protocol’, NHMRC/ARC/UA Guidelines, and University of GoodResearch authorship policy clearly state that ‘acquisition of funding… alone, does not justify authorship.’ (ICMJE, 2006).

With my case for sole authorship in order, I set off to meet with Prof Jenny and Dr Phil. I can’t stop thinking that if the University had provided students with training on this topic at the beginning of candidature, then this whole dilemma could have been avoided. But this experience has taught me several valuable lessons. Firstly, I have learned of the importance of talking about authorship at the beginning of a collaboration or student/supervisor interaction. This is something I will definitely do with my future bosses and colleagues. Secondly, I have learned what it actually means to be an author. Thirdly, that policies and guidelines on authorship exist, including at the University of GoodResearch, and that I should share this information with my fellow students. And finally, I learned from my fellow students that usually in our discipline, the first author is the person who did the most work, and the head of the research group or supervisor is the last author. I’m still not entirely sure what my supervisors think about authorship but I will find this out soon enough.

Authorship issues

As described above, Chris’ story highlights some of the issues faced by postgraduate students wanting to publish results from their thesis research. However the problem of authorship determination is faced by academics and students alike. Evaluation of applicants for research grants and academic promotion is heavily weighted towards the number of publications they author,
and RHD students need publications from their thesis research to secure a research position after their higher degree.

Since the 1950’s, there has been a large increase in both the number of multi-author papers, particularly in the sciences (Brumback, 2001), and in the number of authorship issues (Benos et al., 2005). More authors per paper means more potential problems if communication among co-authors is inadequate. The two main issues surrounding authorship are (i) who can claim author status and (ii) the order of authors (Jones, 1999). The ‘Vancouver Protocol’ describes what constitutes authorship but does not consider how to allocate author order. Author order is of particular importance in some disciplines, such as the biological sciences, and methods for equitable assignment of authorship have been proposed, for example, by Winston (1985) and Beveridge & Morris (2007). In his survey with students from the biological sciences, Chris established that the first author is usually the person who did the most work and the last author is usually the head of the research group. Despite the existence of these published methods which would seemingly enable researchers and students to arrive at a decision regarding authorship in a non-controversial way, authorship issues still exist. One reason for this may be that most researchers and students are unaware that these criteria and methods for author allocation actually exist. Authorship is not a subject universally taught to new students or to current supervisors when they were students: it is something students acquire by osmosis or learn after encountering a problem during their RHD.

Power and responsibility

As described in the Research Quality Framework Submission Specifications released by the Australian Government (Department of Education Science and Training, 2007), publications by RHD students will not be counted unless they are also co-authored by an eligible academic. This may be problematic for students as academic staff may insist they be a co-author or first author on any publications arising from their student’s research project, where previously they were only minor authors, if at all, on these publications. The added pressure the Research Quality Framework (RQF)¹ may bring to both academics and RHD students may see an increase in the number of ethical dilemmas regarding authorship and the order of authors on publications, as more researchers jostle for the prized first or senior author position on each publication.

One suggestion to alleviate this pressure is for institutions and societies to have ethical codes of research which outline authorship criteria. However, some scientific disciplines already have such ethical codes (e.g., American Psychological Association, 1992; ICMJE, 2006), and most (if not all institutions) have a policy on publishing. So why do ethical dilemmas in authorship continue to be problematic among academics and students? One answer to this question, as more fully discussed below, is power.

Student/supervisors collaborations are inherently unequal (Fine & Kurdek, 1993). The power relationship between a student and their supervisor is considered a major critical determinant of the student’s satisfaction and success (Bargar & Mayo-Chamberlain, 1983; Aguinis et al., 1996). Students often struggle with tension in their supervisory relationship. Many recognise ‘that they [are] expected to take on more responsibility for their own learning and develop a sense of ownership of the research project’, with their supervisor concurrently ‘taking too much of a leading role in the relationship and not giving [them] sufficient independence’ (Johnston & Broda, 1996, p. 274). To a supervisor, the research outcomes of a student’s project are ‘important for the discipline and for the supervisor’s own development within the discipline.’ (Johnston, 1999, p.
Furthermore, ‘postgraduate students contribute directly to the supervisor’s research output’, particularly in the sciences, and for some supervisors, ‘work with postgraduate students is seen to be a recognition of their status as senior scholars.’ (Johnston, 1999, p. 24). Moreover, publication together is seen as a validation of their work (Johnston & Broda, 1996) and relationship. With such a vested interest in the outcomes of the student’s research, it’s no surprise that authorship issues arise between students and supervisors.

Many student/supervisor relationships are permanently damaged by authorship disputes. Little, if any, training or advice is currently available to students who grapple with this emotive issue and most students just jump at the chance to author a publication, having little concern for the other names appearing on the by-line. Academics and universities often miss a valuable opportunity to teach their students (or most junior researchers) the best way to handle these issues, so students must learn the hard way how to resolve these problems. The end result for many students may be decreased motivation, change of supervisor/s, lack of engagement with supervisor/s, increased time to completion, or even withdrawal from their postgraduate degrees.

Academics are ‘responsible for promoting the development and growth of students’ (Nguyen & Nguyen, 2006, p. 211), and institutions have the responsibility to prepare graduates for their future careers, equipping them with skills to ‘cooperate with and respect the contributions of fellow researchers and scholars [academics]’ (The University of Melbourne, 2007), and provide them with a ‘clear understanding and demonstration of ethical and social responsibility as a researcher and member of the discipline or field of study’ (The University of Queensland, 2007). It is imperative that both institutions and supervisors foster ethical behaviour among their most junior researchers early in their research careers to reduce potential authorship dilemmas. Teaching them what is ethical and how to behave in an ethical manner will transform the next generation of researchers and benefit the research community.

An alternate proposition to alleviate potential RQF pressure is for institutions to provide training to all new students to teach them about the issues that can occur when authorship is assigned to publications and to provide advice on what to do if authorship issues are not easily resolved. Additionally, this training should also provide students with strategies for avoiding potential problems and ways to promote ethical behaviour in their existing and future collaborations. In addition to informing students about the institution’s publishing policy, the training should build on best practice guidelines such as the internationally recognised ‘Vancouver Protocol’. Early career researchers would also benefit from this training to assist with their transition from student to academic researcher. In a world where evaluation of applicants for research contracts, grants, and academic promotion is heavily biased towards the number of publications and the order of authors on those publications, it is paramount that institutions provide education and training in this area to prepare their students for work in an increasingly demanding global environment.

**Note**

1In May 2004, the then Australian Prime Minister, The Hon John Howard MP, announced that the Australian Government would establish the RQF to develop a basis for an improved assessment of the quality and impact of research in universities and publicly funded research agencies (Department of Education Science and Training, 2005). The 2008 RQF exercise was to drive more than $550 million in existing Commonwealth block funding to Australian universities in 2009. However in November 2007, a new Australian Government was elected and on 21 December 2007, The Hon Senator Kim Carr, Minister for Innovation,
Industry, Science and Research, announced that the new Rudd Government would cease implementation of the RQF in 2008 (Carr, 2007). The new research quality assurance guidelines were under development at the time this paper was submitted so it will be interesting to see what implications these new guidelines have for RHD student publications.

Acknowledgements

I gratefully acknowledge the contributions of Christine Beveridge (UQ School of Integrative Biology/ARC Centre of Excellence for Integrative Legume Research) and Catherine Manathunga (UQ Graduate School/Teaching and Educational Development Institute) for useful comments on this research. Thanks also to Alex Whan for assistance with the questionnaire data and to Lygia Romanach for useful comments on the manuscript.

References


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The PhD in the global knowledge economy: Hypothesising beyond employability

Rachael Pitt
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Abstract
Debate concerning the fitness for purpose of the PhD is increasing within the current climate of a global knowledge economy and discourses surrounding employability and lifelong learning. This paper outlines how these two discourses place the burden for skill or attribute development onto individuals, generally neglecting the notion that these pursuits are socially constructed. The paper then highlights that employability may, in the future, be operationalised differently at the postgraduate and undergraduate levels, with notions of research leadership being of potentially greater relevance than employability discourses when considering PhD graduate outcomes. The aims and methodology of an ARC Linkage Project currently underway are then outlined to illustrate how employability may be examined in terms of the PhD and how this information may impact upon our ideas of what purpose the PhD should fill and how to accomplish this.

Introduction
Debates surrounding higher education are not new and do not show any sign of diminishing in the current climate of increased accountability, diversified funding sources, global mobility, and the emerging knowledge economy. Relatively novel to this debate, however, is the discussion of the processes and products of postgraduate research training, particularly the PhD, and its purposes within this environment (Malfroy, 2005; Pearson, 2005). As Cherry (2005, p. 312) highlights ‘... how do we prepare others ... for situations that are highly variable and novel and that do not neatly match up with the boundaries that we try to maintain between discipline or knowledge areas?’ Similarly, Rip (2004, p. 153) articulates that ‘in the present fluid and dynamic situation, research training has to prepare students for roles and skills that are not yet clearly articulated .... The goals for research training will be moving target posts’.

Some of the fluidity of the current situation is due to the socially constructed nature of education and learning (Boud & Falchikov, 2006), reflecting the changing needs, mores, and values of society (Cabral-Cardoso, 2001; Crebert, Bates, Bell, Patrick & Cragnolini, 2004; Malfroy, 2005). For instance, a university education was once suggestive of the production of a ‘well-rounded’ individual, ready to contribute to society at the highest levels of industry and thought. The situation at present is, however, more reflective of society’s need for new knowledge workers. These individuals will need to be able to quickly adapt to new work environments and roles, minimising lost productivity during transition periods and contributing to innovation and knowledge production and commercialisation (Cherry, 2005; K. Harman, 2002; Park, 2007).

This focus on the ability of university graduates to gain employment and to quickly adapt to and become productive in that environment is referred to as ‘employability’ or ‘employment readiness’. Employability has been attached to a variety of definitions that vary in their level of focus on the individual, the organisation, and government policy (Moreau & Leathwood, 2006; Rothwell & Arnold, 2007; van der Heijde & van der Heijden, 2006). At present, employability concerns the development and utilisation of personal attributes and skills by the individual to assimilate in, and contribute to, the workplace quickly and effectively. External variables are also recognised to be related to employability and can include the labour market and government policy.
Increasingly, the knowledge economy is signalling the imperative for nations to be competitive through innovation in research and development. The importance of research training to produce new knowledge workers to drive this competitiveness is subsequently increasing (Harman, 2004). Initiatives such as the Australian Government’s Cooperative Research Centres (CRCs) Program demonstrate the importance placed on innovation and development in this country (Harman, 2004). Following its inception in the early 1990’s, this program has encouraged collaboration between government, industry, and academia. The aim of this collaboration is to turn ‘Australia’s scientific innovations into successful new products, services and technologies, making our industries more efficient, productive and competitive’ (Department of Innovation, Industry, Science and Research, n.d.). The benefits of the CRC Program for Australia are cited as being threefold and include ‘enhanced skill formation, particularly through the development of highly skilled and industry ready postgraduates’ (Department of Innovation, Industry, Science and Research, n.d.).

The means by which the CRC program enables graduates to become industry-ready appears to be dependent on each CRC. General features common across CRCs, though, include joint supervision between university and industry supervisors, industry funding of scholarships, and access for postgraduate students to professional development opportunities focusing on a variety of employability or industry-ready skills (Harman, 2004). The success of this program to produce postgraduates, including PhD graduates, with ‘skills relevant to industry needs’ (Department of Innovation, Industry, Science and Research, n.d.) has been highlighted in several reviews of the CRC program. For example, a report by Insight Economics (2006) stated that ‘important qualitative benefits arise from the CRC postgraduate programme. The CRC training environment is contributing to the development of industry-focused and industry-ready researchers’ (p. 10). The same report also indicates that one of the benefits to arise from the CRC Program is ‘the development of highly skilled post-graduates who then work in industry and allow industry to be smart adopters and adapters of internationally generated technology/knowledge’ (p. 27).

Within universities, the skills and attributes included in the employability discourse are often regarded as being transferable or ‘soft skills’ (Usher, 2002). Examples of these skills and attributes include teamwork, networking abilities, IT abilities, self- and career-management, commercial awareness, problem solving, flexibility and adaptability, and project management, amongst others (Metcalfe & Gray, 2005; Park, 2007; Precision Consultancy, 2007; Sheldon & Thorndwaite, 2005). Increasingly, these ‘just-in-time, or disposable skills and knowledges are seen as more appropriate than in-depth disciplinary knowledge’ (Morley, 2001, p. 134), especially within industry and government.

It is not a recent development for the fitness of purpose of the PhD to be considered or debated. What is new is that questions are now being raised as to what purpose the PhD should be fit for (Barnacle, 2005; Frame & Allen, 2002; Park, 2007). In particular, the in-depth investigation of and unique contribution towards a specialised field of knowledge, so integral to the definition of a PhD, is increasingly seen to produce obtuse, overly specialised individuals (Barnacle, 2005; Manathunga et al., 2007; McCarthy & Simm, 2007; Usher, 2002). By virtue of their higher educational levels, research postgraduates are often expected to then enter the workforce at a higher level or to produce higher level results (Allen & de Weert, 2007). This focus raises questions about the purpose of research training, the ways in which it is undertaken, what is included within it, and how it is seen to fit within the rhetoric of lifelong learning.
Employability and lifelong learning discourses both tend to place the emphasis of responsibility on the individual, rather than in broader societal constructs. It is, however, notable that the employability discourse also lays a heavy responsibility on higher education institutes to provide the curricular and pedagogical opportunities for individuals to acquire and develop transferable skills (Metcalfe & Gray, 2005; Morley 2001; Teichler, 2007). Neither discourse has, to date, placed any great emphasis on the role that other societal entities play in these processes. In particular, the employability discourse highlights the lack of ‘industry-readiness’ amongst graduates but does not place responsibility with industry to provide work-specific or continuing professional development opportunities (Moreau & Leathwood, 2006; Morley, 2001).

This lack of corporate social responsibility by business and government comes amidst the environment that they have helped shape, in which transferable skills and lifelong learning are integral requirements for the multiple employers and careers that graduates of today’s knowledge economy are likely to face (Metcalfe & Gray, 2005; Morley, 2001; Wilcox, 2006). Moreover, there must be some corporate social responsibility and recognition that employers are part of society, just like universities, and have a role to play in developing the knowledge economy and the workers it requires (Moreau & Leathwood, 2006; Morley, 2001).

The discussion of employability should, therefore, occur within the framework of lifelong learning (Teichler, 2007) and corporate social responsibility. This approach would highlight that learning does not end upon graduation, but rather is constructed within a social environment that is complex and changing (Morley, 2001; Wilcox, 2006). In contrast, the current conceptualisations of employability and lifelong learning are at loggerheads, despite their mutual focus on individual responsibility for learning (Morley, 2001). The current conceptualisation of employability is one of graduates ready and able to become immediate, fully-functioning, productive members of the labour market. This image negates the core tenets of lifelong learning, by which it is recognised that learning occurs continuously throughout the lifespan and that adults will seek out learning to address identified needs (Teichler, 2007).

It is also prudent to remember that universities and vocational institutions are co-located within the Australian higher education sector and serve distinct but overlapping societal purposes (Pearson & Chatterjee, 2004; Teichler, 2007). Universities, with their aim to provide a foundational knowledge of discipline areas and to engage with and question these areas (Teichler, 2007), are not vocational institutions. In addition, even vocational institutions do not fully produce ‘employment ready’ graduates fit for every employment situation in their occupation (Precision Consultancy, 2007). Both types of educational institution aim to produce graduates who are conversant in the basics or fundamentals of their chosen field and who will be able to build upon this foundation in situ within the multiple employments (and potentially multiple careers) that they will face throughout their working lives (Boud & Falchikov, 2006). This is consistent with the notion of lifelong learning, or learning throughout the lifespan, which has been deeply incorporated into global economic and educational policies and rhetoric.

The recent focussing of the employability discourse on research post-graduate degrees (Cargill, 2004; Manathunga et al., 2007) and the pinnacle of academic achievement, the PhD (Frame & Allen, 2002; Pearson, 2005; Usher, 2002) has led to new challenges. For example, many of the skills required for, and honed during, the PhD process seem to have difficulties translating into terminology recognised by employers and the employability discourse (Cabral-Cardoso, 2001; Manathunga et al., 2005; Metcalfe & Gray, 2005). In addition, due to their lengthy association with, and training in, the academic sphere, PhD
graduates may be indoctrinated into and have internalised academic values, making a move outside academia a significant culture change (Carbal-Cardoso, 2001; Park, 2007; Schomburg, 2007). This is supported by graduate reports that by engaging with work and the workplace, they were able to learn how to ‘fit in’ and acculturate to this new environment (Crebert et al., 2004; Schomburg, 2007).

**Contextualising the role and place of the PhD: Looking beyond employability**

Despite these difficulties, the employability discourse highlights that the qualities currently being sought for the knowledge economy require acknowledgement (Morley, 2001; Park, 2007) and integration into new understandings of what university education entails and offers (Barnacle, 2005; Crebert et al., 2004). None-the-less, variables external to the individual graduate are also likely to influence the ways that employability is viewed and measured. For example, it is likely that elite universities will be chosen by students from higher SES areas, thereby introducing a range of pre-influenced financial, social, and educational variables into the development of, and subsequent assessment of, employability skills within these populations (Morley, 2001; Schomburg, 2007). In addition, when discussing the employability of postgraduates, and in particular PhD graduates, it must be remembered that these individuals, by virtue of reaching postgraduate study, should already have demonstrated considerable ability to learn and adapt within the university environment.

The operationalisation of employability at the postgraduate level may, therefore, be found in time to be qualitatively different to that at the undergraduate level, where most discussion has so far taken place (Morley, 2001). For example, there is likely to be greater experience of employment at the postgraduate level, which would feasibly influence the acquisition, development, and translation of skills to industry (Morley, 2001). Additionally, the greater intensity and specificity of study may influence the development and identification of transferable skills (Leonard, Becker, & Coate, 2005; McCarthy & Simm, 2007; Metcalfe & Gray, 2005).

Integral to these considerations is the purpose of the PhD. Whilst its traditional gatekeeper role to academic employment has not abated, new meanings and purposes have been added over time (Usher, 2002). PhD’s are often, for example, referred to as ‘research degrees’ or research training. In addition, there is a move, particularly in Europe (Park, 2007) to treat PhD candidates not as students but as employees. This is further reflected in the use of the term ‘early career researcher’ for this population and those who have recently completed doctoral studies.

Problematic with this conceptualisation are two implicit assumptions: (a) that PhD graduates will be young and/or inexperienced in the field and/or in research, and (b) that they will go on to become researchers (Leonard et al., 2005; Park, 2007; Pearson, 2005). In regards to the first assumption, that of PhD graduates being young and/or inexperienced, this does not appear to be supported by the available evidence. For example, in 2006, 63% of Australia’s commencing PhD candidates were over the age of 29 years (Department of Education, Science and Training, 2007). This suggests that a substantial proportion of Australia’s commencing PhD candidates may not have followed a linear path from secondary school, through full-time undergraduate education immediately into postgraduate research training. This is supported by the finding that in 2006, 33% of all Australian higher education students were listed as being enrolled on a part-time basis (Department of Education, Science and Training, 2007).
These pathways into and through the PhD are now being revealed as important in determining post-PhD outcomes. For example, a recent study of PhD graduates, from the Australian Group of Eight (Go8) universities, found that five- to seven-years post-PhD, those graduates who had been employed in professional or managerial positions prior to undertaking the PhD earned approximately $7,000 more than did graduates who had non-managerial or non-professional employment prior to the PhD. Interestingly, it was also revealed that individuals who may have followed a traditional, linear pathway from secondary schooling through an undergraduate degree to the PhD earned almost on par to those with prior professional or managerial employment. Employment during the PhD was also found to increase post-PhD earnings over those who were not employed during their candidature (Western et al., 2007).

The second problematic assumption with the term ‘early career researchers’ is that of post-PhD employment destinations. The term assumes that research training will result in employment in a research position. Individuals undertake a PhD for a variety of reasons, with Leonard et al. (2005) reporting that only 1 in 7 participants of an open-ended questionnaire responded that they had undertaken the PhD to acquire research skills (Leonard et al., 2005). This is despite the PhD being ‘viewed by governments and universities as primarily providing high level research training for research careers’ (G. Harman, 2002, p. 184). Regardless of initial reasons for undertaking a PhD, G. Harman (2002) and K. Harman (2002) found that amongst a sample of Australian PhD candidates, fewer than 60% planned to follow a research career of any kind after graduation.

Even when considering those who do intend to follow a research career, including careers within academia, difficulties are encountered when viewing the PhD as preparation for this pathway. Within the employability discourse, there has to date, been an emphasis on the skills and attributes seen as necessary for employment within industry settings, with little consideration of the place of academia as an employer and its requirements for future workers (Park, 2007). For example, academia as an employer is likely to require many of the same transferable skill as are industry employers. They are also likely to need employees who are versed and skilled in engaging with academic bureaucracies, issues of pedagogy, curriculum, and assessment within the higher education sector, supervision, finding funding, and working across disciplines (Metcalfe & Gray, 2005; Park, 2007).

It is, therefore, increasingly being suggested that even those graduates who do go on to find employment within the academic environment (the very same environment in which their research training took place and into which they have been acculturated; Cabral-Cardoso, 2001) may not be adequately prepared for employment within that environment (Park, 2007). This situation is likely to increase as academic roles diversify between research only, research and teaching, and teaching focussed positions. Furthermore, the finding by McCarthy and Simm (2007) that non-academic employers hiring for non-research positions want to know why a PhD graduate would choose a non-research position before considering them for employment highlights the difficulties to be faced when negotiating employment away from the academic pathway.

These considerations point to the possibility that the role of the PhD in today’s knowledge economy requires problematising to ensure that it remains relevant to the societal and cultural demands of the time. One avenue by which this problematising may proceed is through discussion of the employability discourse and its different meanings, implications, and outcomes for the PhD (Morley, 2001). PhD graduates have proven themselves at the highest levels of academic achievement but what does this mean in terms of employability in the
knowledge economy? As highlighted by Park (2007, p. 36) ‘one of the most important areas in which the lack of research is hampering the development of both policy and practice is on the links between research training, skills development, employability and the preparation of doctoral students for particular career paths’.

**A methodology to examine the PhD and employability**

The question then is, to what extent does this greater expenditure on learning and training indicate that we should expect something more from PhD graduates than being employable (Morley, 2001)? Metcalfe and Gray (2005, p. 15) suggest that ‘today’s PhD researcher is the highly skilled academic or company researcher of tomorrow’, while K. Harman (2004, p. 401) refers to PhD graduates involved in CRCs as ‘research entrepreneurs’. This leads to queries about whether the skills that PhD graduates have acquired throughout their research training have placed them in a position to become leaders within their field? And, how can we assist PhD candidates throughout their research training to become research leaders?

Research leadership, like employability, is a complex area of investigation, but appears to have received very little study to date. An inter-disciplinary group of researchers from The University of Queensland and Griffith University have hypothesised that, for those graduates who remain within the research field, employability (demonstrated by the possession of basic or adequate skills, knowledge, and abilities) rests at one end of a continuum with the opposite end reflecting ‘research leadership’ (demonstrated by the possession of higher order skills, knowledge, and abilities). Furthermore, it is posited that it is research leadership to which we should be striving to prepare PhD graduates for, rather than employability.

Within the context of these hypotheses, research leadership has been operationalised as comprising two overarching aspects or types of research leaders, namely research management and conducting research of excellence. Research management in this operationalisation refers to the leadership that occurs through the management and enabling of others’ research. It may, for example, entail multiple roles including being the public face of a research organisation or program, liaising with stakeholders, gaining funding sources, and developing the infrastructure potential for new or expanded research programs. The other aspect of research leadership, that of conducting innovative and excellent research, may also be found to involve multiple roles, including some of those listed above for research managers.

To examine the feasibility of these propositions, an ARC Linkage Project is being conducted. The project commenced in 2007 with an examination of the literature regarding research leadership from multiple disciplinary perspectives, including human resource management, social psychology, organisational psychology, and sociology. The understandings of research leadership garnered from this examination have been used to develop a referencing survey of research leaders to ensure that no critical components were neglected. This referencing stage of the project is providing contextualisation of what research leadership entails and how research leaders have perceived their own journey to research leadership.

The results from these information sources have informed the development of a questionnaire to examine how different opportunities and pathways may help or hinder PhD graduates during- and post-candidature along this hypothesised employability-research leadership continuum. Areas included in the questionnaire are: PhD graduates’ personal ambitions/career goals, career trajectory and current employment, their access to employment networks, contacts, role models, and mentors, their access to post-PhD education,
training, and support, and their access to training on graduate attributes and employability skills.

This graduate questionnaire will be disseminated in 2008 to two cohorts of PhD graduates (approximately 5 and 10 years post-PhD) to retrospectively provide information on their opportunities and outcomes. Furthermore, it is hoped that by comparing the pathways of CRC-related PhD graduates with those from more traditional school/departmental settings, the impact of industry involvement and an industry-focus during the PhD will be highlighted. Whilst professional development opportunities designed to increase industry-related skills are also offered to PhD candidates in many Australian universities (Borthwick & Wissler, 2003), it is anticipated that the ‘strong education component’ of CRCs (Department of Innovation, Industry, Science and Research, n.d.) will be evident in the outcomes for those in these programs.

The study aims to triangulate the information obtained from this graduate survey with other data sources, including a survey of employers of PhD graduates and case studies of professional development opportunities provided to PhD graduates once in the workforce. The employer survey is anticipated to occur in 2008 and will be provided to the employers of consenting participants from the PhD survey. Employers will be asked to provide information on areas such as their perceptions of the purpose of the PhD, the types of skills and abilities they are seeking in PhD graduates, as well as what continuing professional development opportunities they provide to the PhD graduates they employ. Following this, in 2009, several case studies will be undertaken to provide further information on the types of continuing professional development opportunities provided to PhD graduates within a range of workplaces, including academia, industry, and government.

The final phase of the study entails the creation of a professional development tool for PhD candidates. This will utilise the information collected in earlier phases, to provide a best practice model for the provision of timely and targeted professional development opportunities during PhD candidature. Included in this process will be a consideration of currently existing packages or programs designed to improve the employability of graduates. Consideration of how such packages can inform policy within Australia and internationally will also be provided.

The study described here has postulated that one outcome of the PhD is the potential for graduates to become research and innovation leaders of the future. The ways in which these graduates are helped or hindered in this process and their career pathways and aspirations are, therefore, influential in providing effective professional development opportunities for early career researchers, including current and future PhD students. The process by which the project is aiming to explore these areas involves the use of a mixed methodology, comprised of questionnaires, case studies, and interviews. It is through this integrative approach that the current project will extend beyond the scope of previous studies and the literature to inform the policy and practice of the PhD employability discourse.

Whilst the study is primarily interested in PhD graduates who remain involved in the research field, those who have pursued non-research employment options are also of interest in understanding the context of the PhD in today’s global knowledge economy. This project aims, therefore, to provide an evidence base upon which to evaluate current research training programs and to provide timely and sound information regarding the preparation of Australia’s future research and innovation leaders. This information will be of critical importance in furthering the debate and policy discussions of research training and employability within postgraduate research degrees.
References


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