Exploring the nexus between research and doctoral education

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Abstract

Exploring the nexus between doctoral education and research, and developments in how research is organised and funded is of significance as doctoral education is both part of the higher education system for teaching and learning, and part of the research enterprise. Doctoral candidates are both students and effectively early career researchers. Drawing on data from an ARC funded study of the development of doctoral programs in Australia including investigation of eight discipline–based case sites, we argue that not only are the settings for research and doctoral education diverse, the settings and arrangements are complex. The findings show that significant features of education include doctoral programs distributed within and across a range of entities, sites and structures, both within and external to any one institution, and including academic departmental structures. We discuss tensions and issues raised by these developments for policy and practices in doctoral education; especially in a university system that has been moving to more corporate models of governance and organization to manage the expansion of student enrolments and pressures for accountability, risk management and quality assurance.

Introduction

The growth of doctoral education, as part of the overall higher education endeavour since its inception post-WW2, broadly parallels the expansion of the university research enterprise. Of interest is the nexus between research and developments in how it is organized and funded, and doctoral education. Exploring this nexus is of significance as doctoral education is part of the higher education system for teaching and learning, and of the research enterprise. Doctoral candidates are both students and effectively early career researchers. When student numbers were small and PhD education proceeded within established disciplinary-based departmental structures, as still can be the case, research and education were and can still be strongly connected. However, over time many research settings and arrangements for doctoral education have become more complex. Our research suggests that changes in both the management of universities and in the research enterprise render problematic aspects of how we manage doctoral education, with implications for policy and practice.

Research is a major national, international and global enterprise. Governments in both the developed and emergent nations are looking to research and research capacity as important for innovation and economic growth. In Australia post Dawkins there are 39 universities providing the great majority of formal research training that takes place, the major award being the PhD. Over time there have been shifts in the strength of different disciplines and the growth of inter and multi-disciplinary research, especially where complex scientific and social issues are under scrutiny (Evans, Macauley, Pearson & Tregenza, 2003)**.** How it is managed is of concern to disciplinary leaders, institutions, industry and government. Varied funding regimes and sources for research have led to the migration of research to specially funded research centres such as Cooperative Research Centres and other funding programs (Turpin, et al. 1999; Harman 2004; O'Kane 2008). These schemes are mainly designed to strengthen innovation and links with industry, all with an explicit commitment to post graduate education (e.g. https://www.crc.gov.au/Information/default.aspx; and http://www.arc.gov.au/ncgp/ce/ce_default.htm; http://www.nhmrc.gov.au/). Centres funded under these programs are often encouraged to participate in and link to international researchers, institutions and agencies, initiatives made more viable with increasing connectivity through virtual media. A more recent example of a government initiative

focused on doctoral training is the Industrial Transformation Research Program (http://www.arc.gov.au/ncgp/itrp/centres_default.htm). This scheme supports industrial PhD students and researchers to gain 'hands-on', practical skills and experience.

One outcome as summarised in a departmental consultation paper, *Defining Quality For Research Training In Australia* (2011c, p.12), is that these developments have produced a variety of settings for doctoral education.

> Although the majority of formal training is undertaken within a university environment, research training can also take place in a wide variety of settings. Besides university environments, research training occurs in medical research institutes and hospitals, in the CSIRO, Cooperative Research Centres (CRC) and in office and industrial settings.

In this paper we explore the variety of settings and argue for the need to take account of the complexity of both the settings and the complexity of arrangements for doctoral programs in these settings that are taking place in what is a distributed and dynamic research environment linked nationally and internationally to a global research enterprise. We draw on data gathered in an ARC-funded study of PhD program development in Australia conducted during 2006-2009. We discuss tensions and issues emerging in this complex and fluid research environment for the management of doctoral education, and for policy and practice.

Methods and approach

Complementing the creation of a regularly updated and coded database of thesis records from 1948 to the present (Macauley, Evans & Pearson 2010), is a series of case studies providing more fine-grained analysis of local activity and human agency, and more recognition of the broad range of stakeholder interests (Pearson 2005a). The case studies of PhD programs were undertaken in selected (sub)disciplinary doctoral programs in four major research-intensive universities to provide data on the introduction, operation and outcomes of selected programs. Situating the case studies in discipline-based programs enables exploration of links to their national and international research and disciplinary communities, and to their professional or industry contexts, while attention to organisational location and structures at the micro-level of specific doctoral programs allows significant issues as to the organisation of doctoral education to emerge.

The case study programs span a range of disciplines— foundational, inter/multidisciplinary, professional and emergent—that established doctoral programs at different times since the inception of PhD education in Australia in 1948: Agriculture, Anthropology, Astronomy, Biomedical Sciences, Chemistry, Computing Science and Engineering, Finance, and Law. Interviews were held on site with current and former academics and doctoral graduates of these programs, and relevant primary and secondary data sources were collected. Interviews were undertaken by the authors following a standard semi-structured interview protocol in person or, where necessary, by telephone (or online). Interviews were digitally recorded to assist transcription and QSRNudist data entry and analysis processes. Interviews were coded according to broad themes, arising from earlier work of the authors that informed the protocols and the analysis (Cullen, Pearson, Saha & Spear 1994; Pearson & Ford 1997; Evans & Pearson 1999; Pearson 2005a, 2005b; Pearson, Cumming, Evans, Macauley & Ryland 2011; Evans, Lawson, McWilliam & Taylor 2005).

Data sources

In total 99 informants were interviewed (mostly on site) of whom 71 were current or retired academics/researchers employed in the site institutions, and 11 employed in allied agencies. Seventeen were graduates of the case study programs working in other institutions (9), or in private industry/business/international agencies (8). Of the 74 academics/researchers at the case sites providing the information, 19 were awarded their PhD in Europe, the United Kingdom, North America or the Asia/Pacific. Primary and secondary sources included Australian government and university

policy documents, official records, published histories on higher education in Australia and of selected universities, and selected case study program policy and planning documents, current and archival records, and program and partner agency websites that documented policy and organizational arrangements for their doctoral programs.

Diverse settings and arrangements for doctoral programs

The evidence gathered in our study shows a diverse array of both settings and arrangements for doctoral education programs that cross formal university academic boundaries and structures for teaching and research. Significant features of these settings and arrangements for doctoral education include:

- a range of entities, research sites, agencies, facilities/infrastructure within or external to any one institution;
- collaborative programs and structures among related and dispersed disciplinary academics;
- research sites hosting inter-institutional groups of candidates;
- candidates with strong or tenuous connection to their Academic Organisational Unit (AOU) and/or institution of official enrolment;
- candidates linked to national and international collaborations, networks, and facilities; and
- varied access to resources for individual candidates

The following case examples of Biomedical Sciences, Agriculture, Astronomy, Anthropology, and Finance, give an indication of the diversity and complexity of local settings and arrangements in particular sites where doctoral education is being enacted (details current at the time of the study).

In the case of Agriculture (including veterinary science) the school AOU is located over multiple physical sites including a major regional based campus and farm previously used as an agricultural college before an institutional merger. Additionally—and historically—PhD candidates have been embedded in a wide range of external entities and sites including the Commonwealth Scientific and Industrial Research Organization (CSIRO), and affiliated government departments such as the Department of Primary Industries, and CRCs in areas including sugar, irrigation, desert knowledge, and beef.

Similarly in the case of Astronomy, doctoral candidates can access facilities for research at their physical home site and AOU, but also at an observatory and associated infrastructure belonging to their AOU situated off campus in a neighbouring state. This site also hosts another observatory jointly managed with a government agency at the same site with access for other institutions. A further extension of access to facilities is presented by opportunities to study at or gain data from other international observatories. Additionally, an adjunct supervisor at the main site for a government agency sited externally to the home institution also working in the field of astronomy hosts doctoral students from the case study AOU and other universities.

In contrast is the case of Biomedical Sciences where there is one physical site - an on campus hospital-based institute. This is an independent entity formed through joint appointments between the two organizations, the institute and the university where it is located. There are more than 200 researchers including PhD candidates. This institute has been afforded exceptional financial support ranging from local service clubs in the early days, to significant funding from state and federal governments, and major endowments from philanthropists who recognize the significance of the research being produced.

Another intra-institutional case site example is that of an Anthropology doctoral program that draws together academics dispersed over six AOUs within the one institution. The two largest AOUs (a school of Anthropology and Archaeology and a department of Anthropology with no undergraduate responsibilities) officially enrol the students. Other academics supervising in the Anthropology Program come from four multi/interdisciplinary centres, as well as a few individual outlier academics

in other parts of the university. A board of studies comprising all the participating academics coordinates the program. Induction, training and a seminar series to support all program students are organised by a Convenor - an academic in one of the AOUs, and additionally by the individual AOUs and centres which host individual students. Interestingly in the case of Astronomy, there is a further example of a collaborative arrangement for cross-disciplinary activity within the one institution. A course is provided for honours students and doctoral candidates by academics from the AOUs for mathematics, physics and astronomy. For the last of these it provides preparation for those entering the astronomy doctoral program with little or no astronomy studied at the undergraduate level.

Finance on the other hand provides an example of inter-institutional collaboration by a number of senior academics over time from neighbouring universities to, as one interviewee put it, 'scale up' their resources and infrastructure for research. The result is a case site where there are in-house databases, access possible to a now privatised company offering research services and databases to universities in Australia and New Zealand, participation in an ARC funded inter-institutional research network hosting events for candidates among other activities, and involvement in a successful off-campus CRC hosting a multi-institution PhD group with their own local seminar program and academics from collaborating universities.

Common to all the case studies are academic interviewees linked variously to colleagues, communities and agencies, locally, nationally and internationally, thus giving substance to the notion that they are part of a cosmopolitan community. In the case of Astronomy, international contact and collaboration are pronounced because for some projects, even at the doctoral level, necessary data and equipment have to be obtained from international facilities in other universities, research institutes and observatories. Moreover, as in science in many fields, the trend to 'big science' projects involves not just the established academics, but doctoral students in international collaborations. In some sites a number of the doctoral graduates reported periods of research and study abroad during their candidacy with international researchers in international institutions, usually sponsored by a supervisor. Candidates themselves, however, may initiate contact with national and international scholarly communities and participate in disciplinary networks, sometimes with a view to obtaining a 'postdoc'. All of this activity is facilitated by the increasing sophistication of communications technologies allowing virtual communities and contacts to flourish.

Given the range of settings, sites and arrangements the result can be a scenario where candidates may have a tenuous connection with their institution or AOU of enrolment. Since most internal and external research centres do not have the authority to award doctorates, all candidates must be formally enrolled by a research degree granting institution, usually a university. Candidates must remain formally connected to an AOU and to the affiliated university with various administrative and supervisory arrangements in place such as adjunct supervisors and co-supervision. Thus, students can be formally enrolled in a PhD program in a specific AOU in a specific university, with administrative responsibility for graduate education in that disciplinary field, but located physically all or most of the time in a research centre that is on or off-campus, which has different resources, a mix of academics and students from various institutions and allied sub-disciplines, its own graduate educational program, and its own particular culture. According to one case site informant, the extent to which a candidate identifies and spends most time with their particular agency or their AOU of enrolment can be a matter of choice. In another case there was a clear distinction drawn in interviews between those who were 'mainstream' candidates on campus and those who were hosted in an affiliated research centre off-campus with an industry focus.

The diversity of funding and resources for research available to individual students can vary considerably. Typically most domestic students are funded directly for tuition through the government's Research Training Scheme and are in receipt of a government or university scholarship (stipend). Some candidates received extra funding from their university, private research institutes, industry and/or employers. A small number pay fees, as do most international candidates (Pearson, Cumming, Evans, Macauley & Ryland 2008). Additionally there are other sources of funding available for individual candidates for their study. In some fields, as noted in the case sites of

Computing Science and Engineering, Finance, and BioSciences, extra support is provided by industry and employers for PhD project funding, e.g. materials, travel, access to data sources etc. In other cases academic supervisors affiliated to a CRC, though still resident on-campus with their doctoral candidates in their AOU, are able to access extra resourcing for their research and that of their students. Funding for individual candidates is also available for those working on specific projects funded through special programs such as the ARC Linkage Grant program, the ARC Discovery Program and those of the NHMRC.

Discussion: issues for policy and practice

With the growth of doctoral education, especially since the 1990s, and the recognition at the government level of the importance of research and research capability for socio-economic outcomes, there has come increased scrutiny of doctoral education and the quality of the doctoral experience. Concerns have arisen as to efficiency and employment outcomes. At the institutional level in response to the need to manage the expansion of overall student enrolments and given pressures for accountability, risk management and quality assurance, efforts have been made in our universities to regulate and structure doctoral education more formally. Senior academics have been appointed as Graduate Deans or Directors, and many graduate schools established, supervisory responsibilities clarified, codes of practice established, supervisors registered, professional development programs provided for supervisors, and support for students. Many of these strategies can be found in the guidelines on 'Best practice' produced by the Council of Australian Deans and Directors of Graduate Studies (DDoGS 2008). However, while there are positive outcomes to be recognised, the strategies such as those in the DDoGs framework reflect a top-down perspective that takes for granted traditional academic management structures as the basis for action. For example, the advice on the research environment advocates that:

> Candidates should have an open, collegial and productive learning environment including a coordinated program of activity to integrate them into their university and faculty, school and/or department … [and that] Cohort or research group activities are particularly appropriate for integrating candidates into the research environment of their university and faculty, school and/or department (p.4).

Similarly in their consultation paper DIIRS (now DIIRSTE) when discussing the research environment for research training takes for granted the basic institutional structures. Quality is to be measured in part by the Excellence in Research for Australia (ERA) where ratings are institution-based and suggestions for those institutions with below threshold ratings are institution-based collaborations such as joint partnerships where one institution has a proven track record (2011c, p.17-18). The recommendations from Council of Australian Postgraduate Associations (CAPA), set out in an earlier paper on *Minimum Resources for Postgraduate Study 2010,* also quoted in this consultation paper (2011c, p. 16) assume institutional structures:

> The quality of university infrastructure is integral to the culture of the university, and the overall student experience. If universities are unable to provide students with adequate workspaces, equipment or other basic facilities, the entire campus culture and student experience suffers.

In question is the relevance of such advice given the increasingly distributed and fluid nature of the current research environment, as discipline (sub) specialties emerge and change direction, as does interdisciplinary activity, so that in many fields research activity in a discipline may be dispersed among various AOUs within and external to the institution. The distribution of research activity and research entities is matched by the dispersal of doctoral candidates, enrolled formally in disciplinary doctoral programs, across physically discrete locations that are also on campus and external to institutions, as is infrastructure and other resources.

The extent of the variation of infrastructure resources available for projects and doctoral students

makes equity a problematic issue. While CAPA sees equity as a major issue, in the DIIRS paper (2011c) the conclusion is that:

> Whilst most universities strive to provide adequate facilities for their research students, evidence suggests that this can be inconsistent both between universities and between different faculties within a university (p. 16).

This is shown in the case studies, and additionally suggests that resources need to be construed more broadly. The variety of funding regimes and resources for research and for doctoral students, combined with the variation in research structures, can result in varying levels of resourcing and opportunities for students within the same larger AOU and institution, and sometimes within the same disciplinary program. The extent of variation in funding even within one scheme, as is the case with the CRC scheme, is confirmed in a recent evaluation study carried out by Manathunga and colleagues (2012, p. 846) in which their attempt to measure doctoral graduate outcomes was made especially challenging by difficulties they encountered in establishing which candidates formed the population appropriate to the study. They found that PhD candidates were included in CRC annual reports if their projects formed a sub-section of a larger CRC project, their supervisor was associated with the CRC, they received funding or in-kind support from the CRC for some aspect of the PhD, or they were wholly placed within or supported by the CRC.

Arrangements for doctoral education in a distributed environment demand flexibility and innovative approaches. This is an issue recognised in regards to interdisciplinary research but, as a series of case studies carried out by an expert panel as part of the DIIRS (2011b) research study revealed, it is also an issue for creating critical mass in enabling disciplines and multidisciplinary fields such as mathematical sciences and education as well. In these fields much of the research activity is taking place in areas of the university other than the formal AOU for that field as shown by the field being reported under a wide range of Field of Research (FoR) codes, and consequently having a lower perceived profile and relevance than is actually the case. This is why the case example of Anthropology is of interest. The Anthropology Program at Institution A offers a way to corral a discipline that migrates into various (sub) fields without losing the opportunities for doctoral students that come from this dynamic through a collaborative approach that has grown organically over time. Although there have been, and remain, competitive tensions openly acknowledged by interviewees, the benefits are seen to make the collaboration worthwhile.

Just as disciplinary critical mass may not need to reside solely in one AOU, so it is the case for institutions that can have access to facilities and research expertise external to any one internal site, and to the institution, nationally and internationally. This distribution of facilities and expertise is illustrated by the case site for Astronomy, and also in Finance, a social science, where the 'scaling up' of resources explained earlier in this paper has created inter-institutional agencies and resources. In a recent study of international postdoctoral employment, Cantwell (2011, p. 112) concludes that the shift to international and enterprise modes of academic production, where work is conditioned by laboratory and project specific demands, calls into question policy focus on AOUs, such as schools and departments. Watson (2012) has raised a question as to the significance of a focus on institutions themselves in higher education debates on research, pointing to the reach of research beyond institutional boundaries. Such caveats apply also to doctoral education where a focus on institutional units and entities ignores the variation in alignment of the diverse settings for research and for doctoral students, within and external to university organizational structures, that can lead to significant aspects of the doctoral education being overlooked in policy and management practices.

The need for flexibility in a distributed environment applies also to supervision. At issue here is what constitutes doctoral education. The DIIRS paper (DIIRS 2011c, p. 16) states that '[t]he supervisor-student relationship is the foundation of research training. What makes for quality research supervision?' Significantly there is no distinction made between a supervisor and 'supervision'. Yet in a distributed and complex doctoral education and research environment illustrated by the case studies this distinction is important. As has been argued by a number of researchers previously,

candidates often access many others for expertise and support (e.g. Pearson 1996; Cumming 2007; McAlpine &Amundson 2012). Halse and Bansel (2012, p. 378) go further and argue that relying on 'the default model of the doctorate … an individualised relationship between student and academic supervisor involving the preparation and supervision of a thesis/dissertation', leads to a focus on quality improvement approaches such as 'professional development for supervisors and tighter regulation, audit and accountability of supervisors and students by universities, government, audit agencies and funding councils.' In contrast, Lee and Boud (2009, p.22) position doctoral education as a social practice in which, '[t]he iconic student-supervisor relationship is subsumed into a diverse matrix of opportunities, resources, monitoring processes and expectations.' In this matrix a doctoral student is involved in a form of situated learning in which they are learning how to do research while doing it; and for this form of experiential learning to be successful doctoral students need access to the full range of practices of their disciplinary/research community (Pearson, Cowan & Liston 2009). The resources and the necessary expertise will not all necessarily reside in their supervisor, supervisory panel or even their research group. Doctoral graduate interviewees in the cases studied saw as critical access to a range of expertise including international research networks. This becomes more important as researchers become more mobile in the increasingly globalised research enterprise.

Concluding remarks

We suggest that regarding the variety of settings, funding regimes and resources as merely more variety of the same kind understates the degree of complexity generated by the changes in the environment for research and doctoral education. There is a major tension underlying the management of doctoral education arising from the move by the university system to more corporate models of governance and organization, increasingly reinforced by the formalisation of standards being mandated by government agencies. A focus on institutional organisational arrangements reflects an institutional top-down provider view of the world. What is needed is more recognition that these complex and fluid spaces and arrangements are on the increase, and more research conducted on the implications for doctoral education, its management, and the quality of the doctoral experience.

In earlier work (Cullen et al. 1994; Pearson and Ford 1997; Pearson et al. 2011) the existence of a more distributed and flexible doctoral education system than that demarcated by disciplinary boundaries and institutional structures has been indicated, but with limited evidence of the dynamics driving the system. Cumming (2007; 2010, p. 36) with detailed case narratives and the use of practice theory (primarily that of Schatzki) further highlights how complex arrangements for doctoral education can be, and argues that:

> … rather than conceiving of doctoral education as a system comprised primarily
> of inputs (e.g. physical and human resources) and outputs (e.g. theses and graduates),
> there is potential for invoking the concept of an 'ecosystem' of many components that
> are interdependent as well as interrelated.

This call for a reconceptualisation of doctoral education and its relationship with the academic research enterprise is further supported by our research on doctoral programs. As such it offers a challenge to policy makers, institutions and academics to seek to maximize the flexibility and opportunities for connections and collaborations across all boundaries for doctoral candidates. This would mean more emphasis on quality enhancement, rather than quality assurance.

Acknowledgement

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