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# A DECADIC REVIEW OF PHDS IN AUSTRALIA

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## Individual paper

### Abstract

This paper reports on an aspect of a pilot project in 2003 by the authors comprising a bibliographic analysis of all (51,000+) Australian PhDs. The pilot work provides both data and methodological bases for a larger project that investigates the nature and development of PhDs in Australia as they evolved in the context of economic, social and educational changes. This paper reviews the evidence from the bibliographic data held in library catalogues of PhDs in each Australian university. It provides a review of the numbers and range of PhDs in Australia for each decade from 1950 to 2000. This is contextualised in terms of the changes to Australian tertiary education over the period and other factors that contribute to the rise of PhDs in Australia.

### INTRODUCTION

Responding to the rapid growth in doctoral education in Australia, Australian scholars in particular have shown a strengthening interest in its research and scholarship, especially since the early 1990s. There have been government-funded reports on doctoral education (Cullen, Pearson, Saha & Spear 1994; Parry & Hayden, 1994; Pearson & Ford, 1997; Trigwell and others, 1997; McWilliam, and others, 2002; Neumann, 2003); government policy reviews that included aspects of doctoral education (Kemp, 1999; West, 1998); conferences on doctoral education (for example, the *Quality in Postgraduate Research* conferences, the *Professional Doctorate* conferences, and more specific conferences such as the *Research on Doctoral Education conference at Deakin 2002* and the *Australian Association for Research in Education* mini-conference on Defining the Doctorate in 2003); special issues of journals (for example, the *Australian Universities' Review* (38, 2 & 43, 2) in 1995 and 2000 respectively, *Higher Education Research and Development* (21, 2) in 2002 and *Australian Educational Researcher* (29, 3) in 2002); books (for example, Green, Maxwell & Shanahan (Eds.), 2002; Bartlett & Mercer (Eds.), 2001; and Holbrook & Johnston (Eds.), 1999), as well as many articles, papers and chapters in various locations. Within this important work there has been considerable focus on the theory and practice of doctoral education, especially concerning contemporary

circumstances and conditions, or particular elements of policy and practice (for example, Brennan, 1998; Evans, 1995, 2000, 2001, 2002; Evans & Pearson, 1999; Holbrook, Bourke, Farley & Carmichael, 2001; Johnson, Lee & Green, 2000; Kiley & Mullins, 2002; Lee, Green & Brennan, 2000; McWilliam & Taylor, 2001; Pearson, 1996, 1999; Pearson & Brew, 2002; Seddon, 2001). However published work that takes a broader social and historical view of the PhD is however much less evident and more limited in scope (see, Coaldrake & Stedman, 1998, pp. 115, 214).

This paper draws on a pilot project (funded by a Deakin University Strategic Research Grant) that is being conducted by the authors to explore the methodological and substantive parameters of a proposed larger project on the 'evolution of the PhD in Australia'. This larger project will investigate the PhD in Australia since its inception in 1948 and do so in terms of an analysis of the economic, social and historical conditions that influenced research and higher education during this period. The pilot project has involved a substantial bibliographic collection, collation, sorting and analysis of all PhD records—approximately 51,000—from Australian university libraries for PhDs awarded at their institutions. This work has provided a database from which a decadic analysis of PhDs has been made for this paper. That is, we have analysed the data each tenth year from 1950 to 2000. In a previous paper (Evans, Macauley, Pearson & Tregenza, 2003) we analysed the data in terms of the development of PhDs in the Creative and Performing Arts.

We shall provide a brief discussion of the PhD in Australia as a background, then focus on the methodological issues we faced in developing the project, and then explain the research design and its implications. The paper then reports on the outcomes of the decadic analysis before drawing some implications for future research in the field.

## **THE PHD IN AUSTRALIA**

The PhD was introduced in 1948 in Australia, the first award being made at the University of Melbourne to Joyce Stone for her thesis entitled, 'Virus haemagglutination: a review of the literature'. The dominant approach to PhD education adopted in Australia (and New Zealand) was similar to that which emerged in the United Kingdom in the early twentieth century. In the UK research training was combined with the existing collegial tradition of personal tutor relationships in undergraduate education, and a disciplinary departmental system (Simpson, 1983; Pearson & Ford, 1997; Becher, Henkel & Kogan, 1994). As in the UK, Australian practice led to individual students being closely associated with individual supervisors as well as individual institutions, and a research program that has been characterised as an 'extension of the BAHons with some research' (Clark, 1995, p. 79). This is in contrast to the practice in Germany, for example, where the award first originated in the nineteenth century, or the American system which adapted German practice combining graduate coursework with research in a PhD program (Gellert, 1993; Gumport, 1993; Clark, 1995).

The numbers of research students in Australia, and PhD students in particular, have grown with the expansion of research in universities post-World War Two. A further growth spurt in the 1990s followed the expansion of the university system as it incorporated the former Colleges of Advanced Education (Holbrook & Johnston,

1999; Pearson & Ford, 1997). Currently there are 31,140 students enrolled in doctorates by research, of whom 16,368 are female (53%); and 22,469 (72%) are over 30 years of age. Some of this diversity in the profile is a result of the growth in the numbers of PhD students in professional fields of study and newly established disciplines as patterns of research itself have changed (ARC/NBEET, 1996). A fast growing field, for example, is Health Sciences. With this growth over time have come concerns about the nature, purpose and quality of research education (AVVC, 1987; Dawkins, 1988; Kemp, 1999). Concerns continue to be raised about completion times (DEET, 1988; Martin, Maclachlan, & Karmel, 2001), the relevance of the award (Sekhon, 1989; Mullins & Kiley, 1998) and calls for new approaches and programs (Clarke, 1996). Increasingly PhD graduates have varying employment outcomes so that the PhD is no longer seen only as an apprenticeship for being a university academic (Thomson, and others 2001).

One response to changing expectations of doctoral study has been the emergence of professional doctorates (Evans, 1997; Trigwell & others 1997; McWilliam & others, 2002). Currently, a total of 131 professional doctorate programs are offered by 35 of the forty Australian universities. Professional doctorates are rapidly emerging in the fields of education, health, psychology and business (McWilliam & others, 2002). The other response has been a liberalisation of PhD rules to accommodate new specialities and ways in which research can be carried out and theses presented (Pearson & Ford, 1997, pp. 23-24).

## **RESEARCH DESIGN**

The data for this paper have been extracted from a very large dataset created by the research team as part of a pilot study on the evolution of the PhD in Australia. Due to the problematic nature of accessing such a large volume of data directly from the National Bibliographic Database—Kinetic—thesis records had to be retrieved piecemeal using a variety of methods. The data were collected from the library catalogues of all Australian universities and transferred into the EndNote bibliographic management program. Sourcing the bibliographic details from all thirty-nine sites enabled the researchers to get closer to the data due to the additional effort required in filtering the records, and added a qualitative dimension to an otherwise technical process.

Initially, all theses identified from Australian-based universities were downloaded using a simple search strategy, for example, searching for 'thesis' and 'university name'. In theory, the term 'thesis' should be part of every bibliographic record for doctorates if catalogued according to the international standard, *Anglo-American Cataloguing Rules*. In the majority of cases, bibliographic records of theses were obtained by searching the respective library catalogues using EndNote Connection files through a Z39.50 interface. The Connection files enable catalogue records to be downloaded directly in EndNote format, without the need for any reformatting or re-keying of data. These files are generally specific to each library catalogue and are normally downloadable from the web pages of the respective libraries or provided with the EndNote program. Alternatively, EndNote Filters were used where library catalogues were accessed using their own search interface and the required records saved as a text file. EndNote Filters are used to convert the text files into EndNote

records. In some instances where EndNote Connection files or Filters were unavailable or not working, the bibliographic records were entered manually.

Once entered into EndNote, all records of minor theses and masters by research theses were excluded, resulting in a total of approximately 53,000 doctorates. This number was cut to 51,168 by restricting the database to PhDs only. To enable the decadic review, theses 'published' in the years 1950, 1960, 1970, 1980, 1990 and 2000 were extracted from the large dataset: a total of 6149 PhDs. Each of these 6149 records were then assigned a classification code according to the Australian Bureau of Statistic's (ABS) *Australian Standard Classification of Education* (ASCED) system which replaced the Department of Education Field of Study (FoS) in 2000. The ASCED is a six-digit classification system that can be used at three levels of aggregation—using all 6 digits (detailed field of study), using the first 4 digits (narrow field of study) or the first 2 digits (broad field of study). For the purposes of this paper, the narrow and broad fields of study have been used. Individual PhD records were assigned an ASCED code based largely on the department or faculty in which the thesis was taken out. However, where the bibliographical information downloaded did not list the department or faculty, coding decisions were made on the basis of the title, key words and/or the call number where present. Of course this process was, at times, problematic as a number of PhD records failed to include any further relevant information other than the title making coding a difficult and time-consuming task.

To enable triangulation of the data, a variety of checks were implemented to establish if the numbers of doctoral bibliographic records downloaded from respective universities matched the doctoral completions from those universities. The methods used included contacting universities for verification, DEST statistical data, and secondary sources such as the literature. The validation process demonstrated that historically the bibliographic control of Australian PhDs has been inadequate, something that was raised nearly fifty years ago at the 1954 Meeting of University Chief Librarians in Melbourne (Radford, 1998). As a result of those discussions the *Union list of higher degree theses in Australian university libraries* (University of Tasmania Library, 1959-) was created. This publication, while a valuable addition to the national bibliography, was dependent upon all universities providing data on PhD (and masters by research) completions—something that is problematic to this day. The *Union List* was last published in 1991 based on data up until 1989 and was subsumed by the Australian Bibliographic Network, the predecessor of Kinetica. Part of our validation process involved a comparison of the *Union List* records against our dataset. Four hundred records from four decades of the *Union List* were checked against our dataset resulting in a 79% hit rate, ranging from 71% for the 1960s to 96% for the 1980s. For comparative purposes we also checked four hundred records from four decades from our dataset against the *Union List*; the hit rate was 89%, ranging from 79% in the 1960s to a high of 98% for the 1950s. It is apparent that there is not a comprehensive record of all Australian PhDs, something our larger study on the evolution of the PhD in Australia hopes to rectify. Consequently, it is acknowledged that the decadic sub-set of PhDs is an underestimation of what exists. Judgments have also been made from bibliographic records and not from the original sources. The absence of subject headings in some cases, ambiguous titles, cataloguing errors, or delays in cataloguing theses—one major university has catalogued only a handful of theses since 1995—has imposed some limitations on our data. However, it is believed

our database of 51,000 Australian PhDs is currently the most comprehensive record in existence.

## **1950–2000 DECADIC ANALYSIS OF THE GROWTH OF PHDS IN AUSTRALIA**

As is noted above, the first PhDs in Australia were awarded in 1948. This followed earlier pressures to introduce the PhD award, particularly in science, which was established first in the Science Faculty at the University of Melbourne in 1946. By the 1950s all universities, but not each faculty, had introduced PhDs. Arts faculties followed suit later in that decade (Dale, 1997). We commenced our decadic analysis by taking the first year of each decade after 1948 and the coding by ASCED narrow fields the disciplines in which they occurred. In most respects, the first year of the new decade is a reflection of the last half of the previous decade. That is, graduations in a given year are products of decisions made about five years (even longer in later years when part-time PhDs become possible) previously and the work undertaken in the intervening years.

What follows are synopses of the PhD graduations each decade from 1950 to 2000. They show the numbers and distributions PhDs by ASCED Narrow (1950 and 1960) and Broad (1970 to 2000) Fields of Study in Australia for the six decadic years. The shift from narrow to broad fields is made to cope synoptically with the increasingly larger numbers in the later years. For the purposes of this joint NZARE/AARE conference, the narrow fields related to Education are aggregated and some particular information related to the field are provided to enable an appreciation of the development of Australian PhDs in Education. These data can be compared to Middleton’s earlier study of the New Zealand PhD in Education (Middleton, 2001). Within the pilot study, it was impossible to code accurately some PhDs by field of study and so these have been listed as ‘Unknown’. Typically this meant that the title and abstract were so opaque that the precise topic could not be determined.

### **1950**

**Table 1: PhDs awarded in 1950 coded by ASCED narrow field.**

<b>Field</b>	<b>No. PhDs</b>
Chemistry	3
Earth Science	1
Physics	1
Medical Science	1
Mathematics	1
Agricultural Science	1
<b>TOTAL</b>	<b>8</b>

Table 1 shows the distribution of PhDs by subject area in 1950. At this point the Australian PhD was clearly in its infancy, but the emergence of the prevailing patterns can be identified. In particular, the sciences were first to develop PhD programs and Chemistry, in particular, was laying the foundations for what was to become one of the most significant areas for PhDs in the coming decades. Earth Sciences and Medical Science are known nowadays as fields of research where Australian researchers perform well above what might be expected for a nation with such a small

population and relatively small economy. In this Table we can see that, in terms of PhDs, the roots were being planted in the immediate post-War period for this subsequent important contribution internationally.

## 1960

Table 2 shows that the total number of PhDs awarded in 1960 was approximately fourteen times greater than a decade before. The Australian PhD was becoming founded across most of the ten universities and across a broader range of disciplines. Chemistry remains strong, but Biological Sciences registers as the most popular field, something that generally can be said to be the case today, although the discipline has mutated considerably over this period.

**Table 2: PhDs awarded in 1960 coded by ASCED narrow field.**

Field	No. PhDs
Biological Sciences	27
Chemistry	12
Studies in Human Society	12
Physics & Astronomy	9
Unknown	9
Earth Sciences	5
Agriculture	5
Civil Engineering	4
Mathematics	2
Veterinary Science	2
Philosophy & Religious Studies	2
Medical Science	1
Computer Science	1
Forestry	1
Environmental Studies	1
Dentistry	1
Political Science	1
Economics	1
Music	1
<b>TOTAL</b>	<b>97</b>

By 1960 we can see that disciplines in Arts Faculties, following their later introduction of PhDs (Dale, 1997) had developed their first PhD programs and graduated some people with their doctorates. In particular, ‘Studies in Human Society’ (which includes, for example, Sociology, Anthropology, History, Archaeology, Indigenous Studies and Human Geography) had formed into a significant field. It was to continue to be strong in the subsequent decades as it went through its own mutations. A more diverse range of Science-related fields was becoming evident, ranging from more basic research fields such as mathematics and physics and astronomy, to many which had a more direct professional focus (for example, dentistry). Of note is that Music was also a field in which PhDs were beginning to be awarded. Music remains the strongest of the Creative and Performing Arts PhDs today (Evans, Macauley, Pearson & Tregenza, 2003).

## 1970

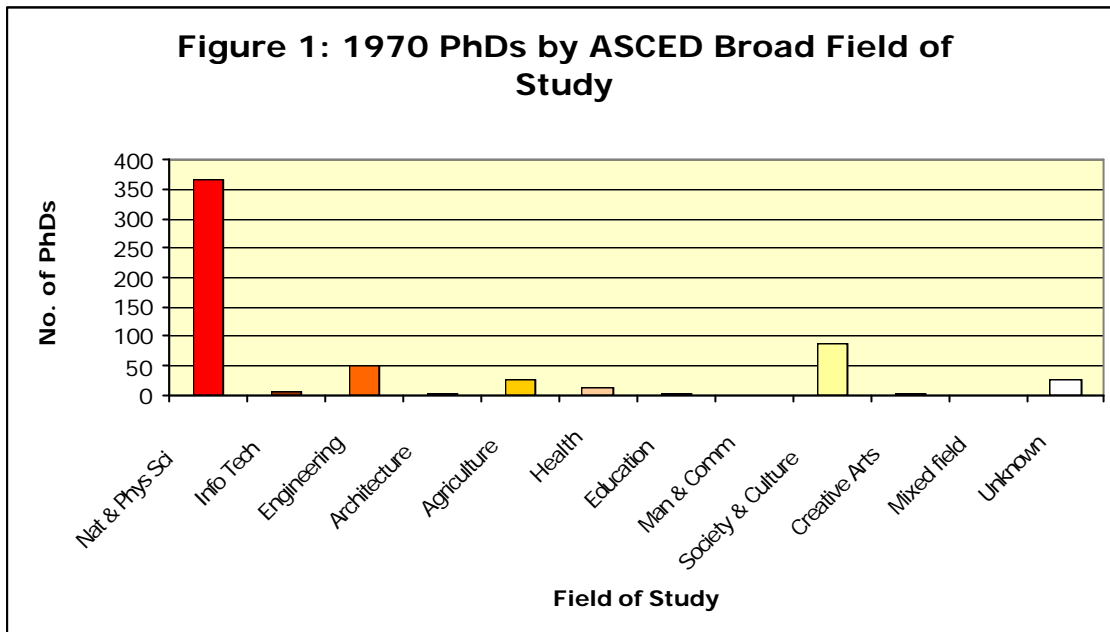
By 1970, several new universities were established in Australia (for example, Monash University and the University of New South Wales) to serve the burgeoning demand from the rapidly increasing young population and to develop further Australia's capacity in science and technology. Table 3 shows that, compared with 1960, the numbers of PhDs awarded increased about six fold. The broad field of the Natural and Physical Sciences contributed significantly to this increase with an average of one PhD being completed each day of the year and representing 63% of all PhDs for the year.

**Table 3: PhDs awarded in 1970 coded by ASCED broad field.**

<b>Broad Field</b>	<b>No. of PhDs</b>
Natural & Physical Sciences	365
Information Technology	5
Engineering	53
Architecture	2
Agriculture	25
Health	15
Education	3
Management & Commerce	0
Society & Culture	87
Creative Arts	4
Mixed field	0
Unknown	25
<b>TOTAL</b>	<b>584</b>

Figure 1 below illustrates the distribution of PhDs across broad fields and shows clearly the domination of the Natural and Physical Sciences in 1970. It is notable that Information Technology established a toe-hold on doctoral programs, as did Education. In both cases the percentages are tiny, that is, 0.9% and 0.5% respectively. The first Education PhDs were awarded in 1970 at the University of Queensland and Australian National University (see, Colston, 1970; Watts, 1970; Batt, 1970). Society and Culture continue to indicate strengthening PhD programs and that the science-based professions (Engineering, Agriculture) are consolidating their positions.





## 1980

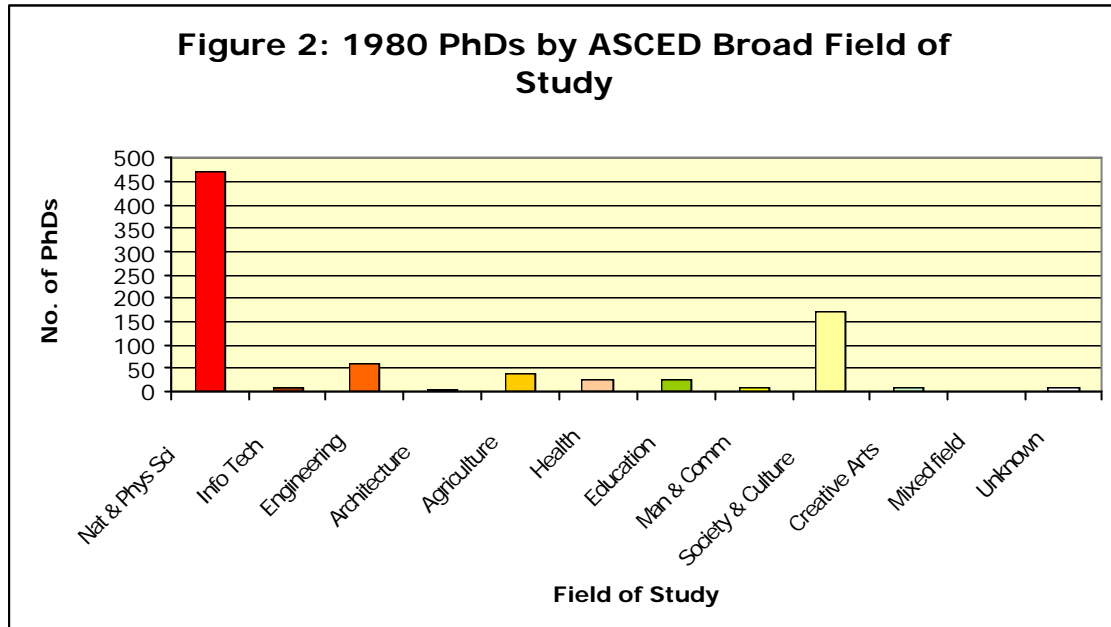
Table 4 shows that, although total numbers increased from 584 to 836, there was a further decline in the growth rate of the total number of PhDs over the previous decadic selections. Whereas there were twelve-fold and six-fold increases in 1960 and 1970 respectively, by 1980 there was 'only' a 70% increase. Indeed, the raw figures show that in 1970 there was an increase of 487 PhDs over 1960, whereas the increase for 1980 over 1970 was an increase of 252.

**Table 4 PhDs awarded in 1980 coded by ASCED broad field.**

Broad Field	No. of PhDs
Natural & Physical Sciences	471
Information Technology	12
Engineering	60
Architecture	3
Agriculture	40
Health	25
Education	24
Management & Commerce	9
Society & Culture	174
Creative Arts	6
Mixed field	1
Unknown	11
<b>TOTAL</b>	<b>836</b>

Table 4 and Figure 2 show that the trends established in previous decades continued with the Natural and Physical Sciences comprising 56% of all PhDs (down from 62% in 1970), and Society and Culture cementing itself as the second largest field with 21% of all PhDs (up from 15% in 1970). Education's numbers increased eightfold

over the 1970 numbers and comprised 2.9% of all PhDs. Management and Commerce, and the Creative and Performing Arts broad fields recorded small numbers of PhDs in 1980.



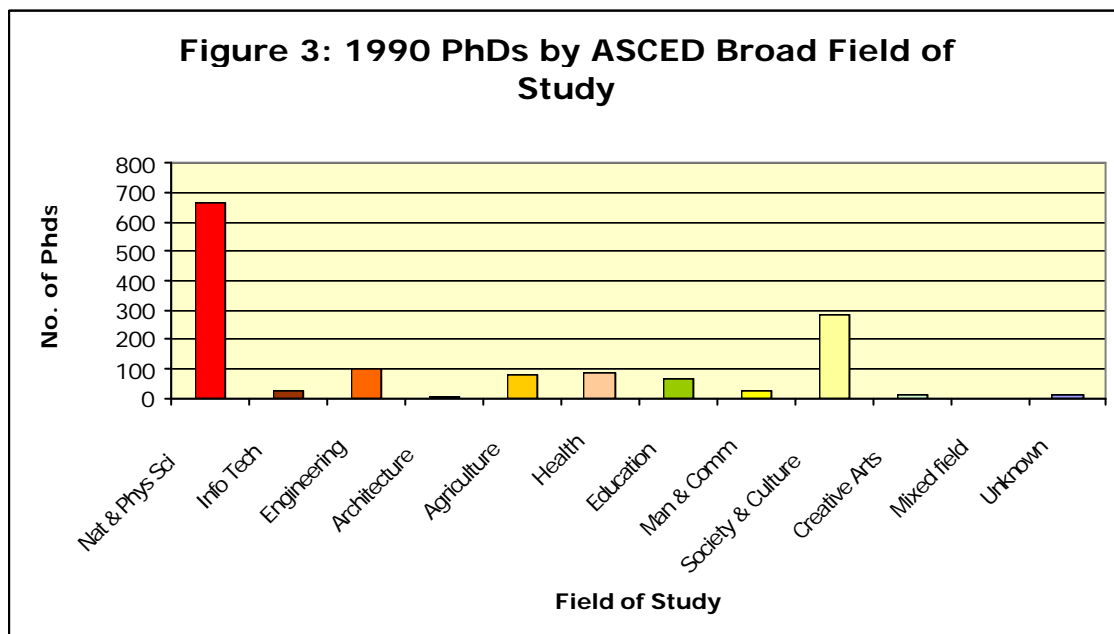
Although several new universities were established in the 1970s (for example, Murdoch, Deakin and Griffith) these contributed little to the overall 1980 numbers. The 1980 analysis comprises principally the Sandstone universities' graduations with some graduations, notably with higher than average proportions in the social sciences, from those universities established during the 1960s.

### 1990

Table 5 and Figure 3 below show that, although the number of PhDs increased in 1990 by 531 over 1980, again the percentage increase reduced in this decadic comparison, down to a 61% increase. Education's proportion of all PhDs continued to improve to 4.6%, whereas the Natural and Physical Sciences declined to 49%. However, as Figure 3 illustrates, this latter field remained dominant. Society and Culture sustained 21% of all PhDs. In effect, the broad fields which in the 1970 and 1980 decadic comparisons had very few, if any, PhDs awarded, have begun to show major increases from their low bases.

**Table 5: PhDs awarded in 1990 coded by ASCED broad field.**

Broad Field	No. of PhDs
Natural & Physical Sciences	667
Information Technology	30
Engineering	100
Architecture	6
Agriculture	82
Health	88
Education	63
Man & Commerce	21
Society & Culture	285
Creative Arts	12
Mixed field	0
Unknown	13
<b>TOTAL</b>	<b>1367</b>



The 1990 decadic analysis occurs just as the ‘Dawkins’ period of higher education reform was beginning to take effect on universities and the Colleges of Advance Education (CAEs). Mergers and redesignations to university status occurred during this period. This unleashed a demand for more staff with PhDs, however, the consequences on PhD graduations would not occur for several years. Thus, the 1990 PhD figures reflect the development of newer PhD programs in the pre-Dawkins (that is, pre-1988) new universities established in the mid-1970s and early 1980s, together with the general expansion in PhD programs in the older universities.

## 2000

The final year of the decadic analysis does reflect the impact of the Dawkins reforms to the university and CAE sectors into what was known as the Unified National System. The focus on research and ‘research training’ (that is, PhD programs in particular, and higher degree by research programs in general) as key signifiers of university work became prominent. These drove newer (post-1987) universities, especially, to recruit staff with PhDs and to encourage existing staff to obtain their PhDs if they did not already possess such.

Table 6 shows that in 2000 there were 3247 PhDs awarded, an increase of 1880 over 1990. This represents a 58% increase over 1990. Therefore, despite the powerful PhD incentives in place during this period, the percentage increase dropped slightly. It is notable that the Natural and Physical Sciences, although sustaining a clear lead as the major field, saw another decline in the proportion of its PhDs to 32%. Education increased to 5.4% of PhDs. Society and Culture also increased slightly to 24%.

**Table 6: PhDs awarded in 2000 coded by ASCED broad field.**

Broad Field	No. of PhDs
Natural & Physical Sciences	1029
Information Technology	105
Engineering	294
Architecture	31
Agriculture	157
Health	370
Education	174
Management & Commerce	142
Society & Culture	781
Creative Arts	61
Mixed field	2
Unknown	101
<b>TOTAL</b>	<b>3247</b>

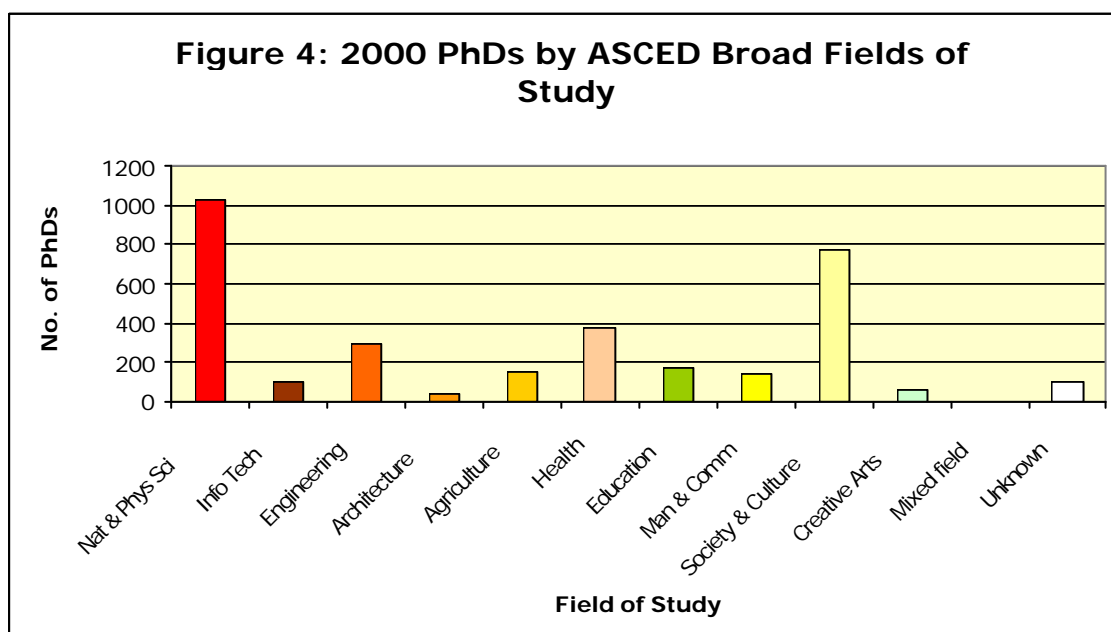


Table 6 and Figure 4 show that there were big changes in the array of other fields where proportions of all PhDs increased significantly. For example, Creative Arts had 1.9% of all PhDs, up from 0.9% in 1990, Information Technology had 3.2% up from 2.2%, and Architecture had 1%, up from 0.4%. Although the total numbers are small, they are making bigger increases than the Natural and Physical Sciences and, therefore, gradually shifting the balance of the fields in which PhDs are awarded.

### **Concluding comment**

The work represented in this paper contains original data and analyses from a pilot study focusing on the evolution of the PhD in Australia. Its data source is the PhD records held in the conferring universities' libraries. The reliability of the data is determined, therefore, by the efficacy of each library's cataloguing and catalogues, in some instances going back over fifty years. The cross-checking undertaken showed that there were some omissions and errors, which were corrected, however, it is expected that there are some other errors yet to be traced. The nett effect is that the data reported here are likely to be less than the actual numbers of PhDs in total. Likewise, those categorised as 'unknown' may have a minor effect on the Fields of Study distributions. Notwithstanding these underestimates, clear patterns can be established from the decadic analyses reported.

In general, it can be said that the Australian PhD has risen from 1950 when only seven PhDs were awarded—equivalent to less than one every seven weeks—to 2000 when 3247 were awarded—equivalent to nine per day. Although, this is a profound change, the early decadic increases were proportionally much greater than those of the later decadic periods. This suggests that a plateau may be reached in next two decades when PhD growth might resemble the growth in university student populations more generally. There are factors that may affect this suggested levelling of growth. One is that 'credential creep' will continue to increase the number of PhDs being pursued beyond the next two decades as an expanding graduate population seeks higher qualifications. Another two factors may counter this and, indeed, reduce the number of PhDs over this period. One is the rise of professional and other doctorates that took effect over the 1990s and into the 2000s. These doctorates may take some potential students away from PhD programs (although the total number of doctorates could still rise). The other is the reduction in funding of higher degree by research places by the Australian Government. This reduction is about 20% from 2002–2005. Therefore, from 2005 we expect that there will be a decline in PhD numbers continuing until about 2010, given that the typical candidature period for part-time students is approximately double that for full-time students. A final factor is the rise of international PhD students which, over the next two decades, could help ameliorate the decline in Australian Government-funded places.

It is unclear how all these factors will affect PhD numbers and how they will interact with each other. However, it does appear likely that the numbers of PhDs are not going to grow at the pace that they have done over previous decades.

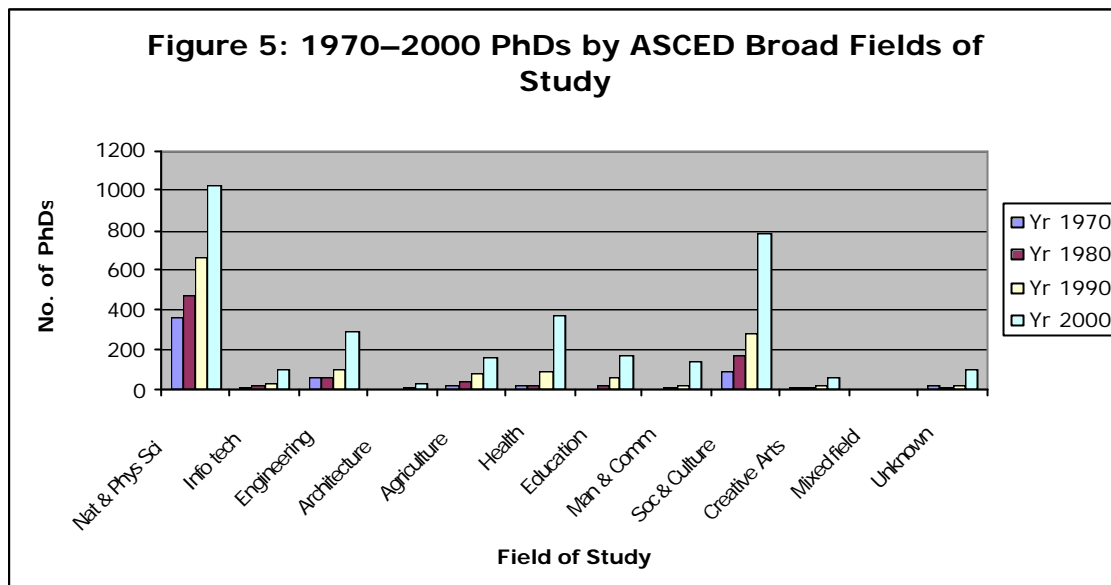


Figure 5 shows the distributions from 1970–2000 of PhDs by the ASCED Broad Fields of Study. This shows that each area has played its part in the growth of PhDs in Australia, however, it also illustrates the relative positions of the different fields in particular years and how this has changed over the four decadic periods selected for analysis. There appears to be a gradual shift occurring between the fields. Society and Culture is moving towards a balance with the Natural and Physical Sciences, and the various smaller fields related to professions, industry and commerce are, collectively, greater than both these fields with 1334 PhDs awarded in 2000.

Education PhDs have played a significant part in the growth of the professional, industry and commerce fields. It is notable that Doctor of Education degrees were amongst the first professional doctorates in Australia over ten years ago and they are also the most common of the professional doctorates available. At least on the 2000 figures, EdDs do not appear to have negatively affected PhDs in Education in Australia. The evidence in this paper indicates that professional doctorates in general, have not affected the popularity of PhDs. Indeed, there is anecdotal evidence that professional doctorates are losing ground in some fields, including Education.

As noted above, this paper is based on a pilot study that is currently in progress. Our expectation is that with further analysis of the data and some comparisons with other data that this paper will be revised and extended for publication.

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