CHARACTERISTICS, DEGREE COMPLETION TIMES AND THESIS QUALITY OF AUSTRALIAN PhD CANDIDATES

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Background and Literature

Introduction by DEST of the new Research Training Scheme (RTS) has tightened the financial guidelines for direct governmental support of research higher degree candidature, raising concerns about degree completion and timeliness. There are two issues at the forefront of concerns by government, universities, postgraduate student associations, and candidates themselves:

1. candidate attrition during candidature resulting in non-completion of the degree, and

2. a longer-than-normal period of candidature, even though the extended candidature results in successful completion of the degree.

Non-completion is of greater concern for both the candidate personally and the university, whereas extended candidature leading to completion may be a problem only for the university, carrying financial penalties within the RTS. However, there clearly may also be financial and personal costs for candidates who take more time. Although candidature completion and attrition are not directly addressed in this study, completion and time taken are closely linked in the literature, and both will be addressed briefly here.

There has been concern about research higher degree non-completion and time taken to completion at least since the 1980s, in Canada, UK, USA, and Australia (see, for example, Smith et al.,, 1993; Sheridan & Pyke, 1994; Kerlin, 1995a & 1995b; Holdaway, 1996; Haksever & Manisali, 2000; Lovitts & Nelson, 2000; Martin et al.,, 2001; Elgar, 2003). In some cases, reported studies have focussed on attrition statistics, with some American attrition estimates for doctoral studies being far greater than 50 per cent (D'Andrea, 2002). However, some university estimates have suggested that attrition over the first several years of candidature is less than 40 per cent. (For example, the University of Arizona's published statistics indicate that 36 per cent of PhD candidates in the 1990s 'attrited' in their first six years of candidature.) Other studies have suggested that more than one third leave in the first year (Lovitts & Nelson, 2000, p.49). At the high end of the scale, some estimates based on cohort studies have been that doctoral candidate attrition overall may be as high as 85 per cent in the USA (D'Andrea, 2002). At the lower end, Colebatch (2002) suggested that completion rates for research degrees in Australia have increased considerably since the 1980s to between 80 and 90 per cent in the mid 1990s. A recent study in Canada indicated that discipline is important for completion, with completion rates varying from 45 per cent in arts and humanities to 70 per cent in life sciences, with science completions being generally in the high 60 per cent range (Elgar, 2003). For the U.K., completion rates after 10 years differed by general discipline area with arts/humanities rates being 51 per cent, and sciences being 64 per cent (Wright & Cochrane, 2000). For Australia, Martin et al., (2001) estimated that 60 per cent of beginning doctoral candidates in 1992 would have completed successfully by 2003 (that is 11 years after initial enrolment), suggesting an attrition rate of 40 per cent. The same study also reported 'considerable variation' in completion rates between institutions and disciplines.

Apart from discipline differences that may exist, in the USA institutional arrangements have been found to be important for attrition, which ranged from 33 per cent in one university to 68 per cent in

another (Lovitts & Nelson, 2000). This study also suggested that different departmental arrangements for graduate students within the one university may be the key to discipline differences in attrition (pp.45-46), with two of the largest factors contributing to student departure being lack of integration into the department's intellectual and social community, and the organisational culture of the graduate school. Lovitts & Nelson also reported that the single most important factor for completion was relationship with a faculty adviser—students who completed being twice as likely to express satisfaction with faculty advisers (p.49). But the direction of any causal link here was undetermined. In the same vein, the most frequently given reasons for non-completion of PhDs in the UK over a number of studies were problems with supervision (Haksever & Manisali, 2000).

Completion time for research higher degrees is calculated in a number of ways. One measure commonly used in the USA has been the time from completion of a bachelor's degree to completion of the graduate degree in question (Kerlin, 1995). This measure would make little sense in the Australian situation where, in some disciplines, there is an expectation that professional experience should be gained before proceeding with a research degree. A simple and more useful measure in our circumstances is elapsed time—that s the time from first enrolment in the research higher degree to completion of the degree. This measure has been extensively used, in part because it can usually be readily determined with a high level of accuracy (see Sheridan & Pyke, 1994). However, such a measure does not account for the nature of student enrolment (full-time or part-time) or any leave taken from studies during candidature. A variant on elapsed time is 'registered time', which excludes time before enrolment in the doctorate and any leave taken during the doctoral candidature (Sheridan & Pyke, 1994). More useful measures of completion time, which recognise the nature of enrolment as well as any leave taken, are more complex and elusive because the necessary information is often difficult to obtain—which perhaps explains why they are seldom used. Part of the difficulty arises from the changing patterns of enrolment in research higher degrees, at least in Australia—almost one-third of successful PhD students now utilise a mix of full-time and part-time enrolment during their candidature.[1] Under the RTS, it is the full-time equivalence of enrolment in a research higher degree that is important for student funding. For the measure of enrolment time used in these circumstances, leave is also excluded. The enrolment measure is candidacy time, being the number of equivalent full-time semesters actually enrolled in the PhD degree, with part-time enrolment counted as half that of full-time enrolment.

Whether total time or registered time was used to measure time-to-degree for doctoral students, it was suggested by Kerlin (1995) that the length of time taken had risen 'in recent years' in most disciplines. In Australia, for six universities since 2000, we can say that the mean candidacy time was 7.9 semesters (or almost 4 years) for completing candidates, and their mean elapsed time was 5.0 years.[2] For the same sample, candidacy time by Broad Field of Study ranged from a mean of 7.2 semesters in Education to 8.3 semesters in Agriculture, with Science at 8.0 semesters and both Arts and Engineering at 8.2 semesters. The results of this study are generally not consistent with international studies which frequently show Science as having the shortest candidatures and Arts and Humanities the longest. However, as indicated above, the measures of enrolment used in the overseas studies were more coarse. If elapsed time were used in the Australian study reported

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1   On-going work in the PhD Examinations project (described by Holbrook, Bourke, Farley & Carmichael, 2001) indicates that, for 601 candidates across the six universities involved to date, 55% of candidatures were entirely full time, 14% entirely part time, and 32% were a mix of full-time and part-time.

2   From the PhD Examinations project described by Holbrook, Bourke, Farley & Carmichael (2001).

above, Business and Science candidates would have had the shortest mean times (4.7 years), and Arts, Humanities and Social Sciences candidates the longest (5.7 years).

Time of candidature measures aside, a pattern of relationships of factors with successful research higher degree candidature has been identified over the recent past. An extensive review of research on attrition rates and completion times (Latona & Browne, 2001) found associations with improved completion rates for factors in three areas, namely institutional/environmental factors (including discipline differences, candidature guidelines, and a sense of belonging), supervision arrangements (feedback, meeting frequency, relationships, an early start, and uninterrupted arrangements), and student cohorts and characteristics (entry qualifications, nature of enrolment, discipline differences, and psychological factors). The following have also been found by others to be related to completion: entry qualification and age (Wright & Cochrane, 2000), gender and demands of outside employment (D'Andrea, 2002), provision of direction and motivation and indirect help such as outside contacts (Haksever & Manisali, 2000), national citizenship (Sheridan & Pyke, 1994), having a scholarship and undertaking coursework (Smith et al, 1993). For Australia, Martin et al., (2001) reported differences in completion rates by gender (females had higher a completion rate), age (very young and older students had lower completion rates), and study mode (full time students had higher completion after seven years, but this would be expected given that the 'normal' length of part-time candidature is up to eight years). Using full-time equivalent enrolment as the measure of completion times, the PhD Examinations project has found that across 601 candidates, females had a slightly longer candidacy than males, older students completed more quickly than younger students, and part-time students had shorter candidacy than full-time students.

The focus in this brief review has been on doctoral candidacy. Similar issues emerge for research masters candidates indeed, Martin et al., (2001) estimated that their completion rate was less than 50 per cent, that is it was markedly lower than that for doctoral candidates.

The present study

Information suitable for investigating relationships between candidature, completion times, and quality was available for 601 PhD candidates at six Australian universities. The information was obtained as part of a large study of PhD examination being undertaken by the Centre for the Study of Research Training and Impact (SORTI), at the University of Newcastle. The study forms part of a series of projects in the area, the next being a study focussed more specifically on research pathways and degree completion. This project will also examine attrition rates and possible reasons for failure to complete research higher degrees based on the three areas identified by Latona & Browne (2001—environmental factors, supervision arrangements, and student characteristics.

Descriptive data on time and results

Relationships between candidature characteristics and candidature time

Hypothesised causal relationships between a wide range of 26 candidate, candidature and institutional variables and candidature time were examined using multiple linear regression analysis. The list of potential explanatory variables available for these analyses is shown below,

with variables grouped as (1) candidate characteristics, (2) candidature characteristics, (3) discipline area (BFOS), and (4) University of enrolment.

1. Candidate characteristics

- Gender

- Age at commencement

- Entry qualification (honours, research masters, coursework masters, other)

- Local or overseas student

- Whether a native English speaker

- English proficiency

2. Candidature characteristics

- Proportion of candidature that was full time

- Whether fee paying

- Whether a scholarship was held

- Whether upgraded to a PhD during candidature

- Semesters of leave taken

- Whether change in supervision

- Whether candidature problem was notified

3. Discipline area—Broad Fields of Study

- Agriculture

- Arts, Humanities & Social Sciences

- Business (including Law & Legal Studies)

- Education

- Engineering (including Architecture & Built Environment)

- Health (including Veterinary Science)

- Science

4. University of enrolment included University 1 to University 6 inclusive

Five candidates who were shown as having unusually short candidatures were omitted from the analyses, which were conducted with the remaining 596 candidates. The omitted candidates had less than one year of elapsed time from initial enrolment to thesis submission, or less than two semesters of equivalent full-time candidature. It is likely that they had transferred from another university just before submitting their theses, but nothing of any previous candidature history is known.

Elapsed Time and Candidacy Time

First, all variables in the four groups were entered into two separate multiple regression equations as explanatory variables with elapsed time and candidacy time as the response variable in each case. A progressive backward elimination of variables with non-significant regression coefficients was undertaken. Using the 0.05 probability level for significance, it was found that a total of 11 explanatory variables were significantly related to one or both of the candidature time variables available—total time from first enrolment in the degree and submission of the thesis (called 'elapsed time'), and time of enrolment in full-time equivalent semesters ('candidacy time'). The lists of significant variables are shown in Table 1.

When the variable groupings were considered in separate regression equations, it is of interest to note that, for both response variables, the set of candidature characteristics was the most important group, explaining almost 35 per cent of the variance in elapsed time and almost 10 per cent of the variance in candidacy time. Continuing with elapsed time as the response variable, candidate characteristics were next in importance (5%), followed by BFOS (4%) and finally University (2%). Shared variance resulted in 38% of the total variance in elapsed time being explained when all the significant variables were included simultaneously. For candidacy time as the response variable, University of enrolment was second in importance (6%), followed by candidate characteristics (4%) and finally BFOS (1%). In this case the total variance explained in candidacy time by all significant variables was 22 per cent.

Table 1 lists the significant explanatory variables for both response variables in descending order of importance for elapsed time (as determined by the standardised regression coefficients shown). The nature of the relationships of these explanatory variables with the response variables is now described.

Proportion of full time enrolment. Being enrolled full time gives a shorter overall candidature in elapsed time, and it is clearly the most important variable for elapsed time. Other things being equal, it would be expected that part-time enrolment should take twice as long as full-time enrolment measured by elapsed time. But full-time enrolment results in a longer candidature time when measured in equivalent full-time semesters (candidacy time). There is no obvious reason why this should be the case, except perhaps the possibility that many part-time candidates work on their theses for more than half a normal working week.

Candidature problem notified. Candidates who notified a problem during candidature took longer, in particular in candidacy time, for which this was the most important explanatory variable.

Scholarship held. Candidates who held a scholarship had shorter candidature. These candidates would, of necessity, be full-time students and would tend to have entered the degree with more impressive entry qualifications than most other candidates. One might imagine that entering with higher qualifications should assist degree completion, but entry qualification was not related to completion time.

Age at commencement of candidature. On average, older candidates had shorter candidatures on both measures. They would also tend to be more often enrolled as part-time candidates.

Native English-speaker. Being a native English-speaker results in longer candidature. This is probably a counter-intuitive finding, given the language problems of overseas candidates frequently documented and discussed. In most cases, non-native English speakers would also be overseas students, either on scholarship or full-fee paying. Either of these latter characteristics would tend to lead to more urgency in completion and thus shorter candidacy.

Arts, Humanities, Social Sciences BFOS. Candidates enrolled in this BFOS generally had longer elapsed time, although not a longer candidacy time.

Table 1. Standardised regression coefficients of effects of predictor variables on two response variables: Elapsed candidature time and equivalent full-time candidature

Predictor variables	Response variables	
Candidature & other characteristics	Elapsed time [1]	Candidacy time [2]
Proportion of FT enrolment	-0.467	0.227
Candidature problem notified	0.267	0.374
Scholarship held	-0.143	-0.137
Age at commencement	-0.142	-0.145
Native English speaker	0.092	0.112
Arts, Human., Soc.Sciences BFOS	0.068	NS
University 5	NS	-0.311
University 2	NS	0.158
Semesters of leave taken	- [3]	0.099
University 4	NS	-0.091
Female candidate	NS	0.076
Engineering & Architecture BFOS	NS	0.071
Total variance explained	38%	22%

Notes:
1. Time from first enrolment in the degree to submission of the thesis for examination.
2. Length of candidature in equivalent full-time semesters of enrolment (with periods of leave from candidature omitted).
3. Semesters of leave was not included as a variable in the regression equation with elapsed time as the response variable. Clearly any leave taken would add to elapsed time.

There were also four variables that were related to candidacy time but were not related to elapsed time.

University. On average, candidates at Universities 4 and 5 had shorter candidacy times, and candidates at University 2 had longer candidacy times than candidates at the other three universities. It would be necessary to look closely at individual university candidature mix and policies in attempting to identify possible reasons for these between-university differences.

Semesters of leave taken. Candidates who took leave also had longer candidacy time. This was not expected, unless candidates were taking leave to assist completion when their normal candidature was in danger of expiring. If this were the case, perhaps leave should have been taken earlier in some candidatures.

Candidate gender. Female candidates, on average, had a longer candidacy time than male candidates. Gender was not related to elapsed time. Gender is also clearly related to some BFOS,

with majorities of female candidates in Education and in Arts BFOS, and a very small percentage of female candidates in Engineering.

BFOS of enrolment. Candidates enrolled in the Engineering disciplines generally had longer candidacy time than candidates in all other disciplines. Engineering also had the highest proportion of full-time candidature (at 90%) compared with all other BFOS with a mean proportion of full-time candidature of 74 per cent.

Other BFOS

Of note here also is the lack of relationships between other BFOS and the length of candidacy time to completion. In particular, when the proportion of full and part-time candidature is taken into account, as it is in regression analyses, candidatures in Arts, Humanities and Social Sciences were not longer than candidatures in the natural sciences.

This finding runs counter to previous research (see ESRC 1987) and to popular belief, the latter probably fostered by the simple correlation between full/part-time candidature and BFOS. The point-biserial correlations between percentage of full-time candidature and each of the BFOS indicated significant negative relationships for two BFOS, namely Arts, Humanities and Social Sciences and Education (with coefficients of the order of -0.16 to -0.18), and two significant positive relationships, for two BFOS, namely Engineering and Science (with coefficients in the range 0.14 to 0.16). Clearly, the Arts, Humanities and Social Science and the Education candidates were more often enrolled part-time, and the Engineering and Science candidates were more often enrolled full time.

Relationships of characteristics and time measures with thesis quality

Examiner recommendation and committee decision on the thesis were taken as measures of thesis quality. Each of these measures was collapsed to a five-point scale, ranging from acceptance of the thesis without alteration to fail. Examiner recommendation was calculated as the mean recommendation of the two or three examiners for each thesis, depending on the university involved. It is of interest that there were no significant relationships between either of the time measures and the two measures of thesis quality—in fact the coefficients approached zero.

When tested using a multiple linear regression analysis, the same variables in the areas of candidate, candidature, discipline area, and university of enrolment were not strongly predictive of thesis quality (see Table 2). Eight relatively weak but statistically significant explanatory variables predicted only 6 per cent of the variation in examiner recommendation. Seven of these variables were related to the thesis receiving a lower examiner recommendation—Universities 6 and 2, BFOS Agriculture and BFOS Science, having a coursework masters degree as entry qualification, candidate age, and a candidature problem notified. One variable, having had a scholarship, was related positively to examiner recommendation. Given that scholarships are awarded to applicants with the highest entry qualifications, such a result was not surprising. Scholarships are also available only for full-time candidature. However, none of the range of entry qualifications recorded, including entry by masters coursework, was related to either candidature time or result obtained.

Table 2. **Standardised regression coefficients of effects of predictor variables on two response variables: Mean examiner recommendation and committee decision on the thesis**

Predictor variable	Response variables	
Candidature & other characteristics	Examiner recommendation [1]	Committee decision [1]
University 6	-0.111	NS
University 3	-0.087	NS
Agriculture BFOS	-0.137	NS
Science BFOS	-0.096	NS
Entry masters coursework	-0.092	NS
Age at commencement	-0.085	NS
Candidature problem notified	-0.083	NS
Scholarship held	0.081	0.073
University 1	NS	-0.087
University 4	NS	-0.125
Total variance explained	6%	2%

Note:

1. Both examiner recommendation and committee decision were reported as 5-point scales: (5) 'Accept the thesis without alteration', (4) 'Accept the thesis but invite minor amendment', (3) 'Require correction of the thesis before acceptance', (2) 'Require the thesis to be revised and resubmitted for examination', and (1) 'Fail'.

Approximately 2 per cent of variation in the committee decision on the thesis was predicted by three of the characteristics and institutional variables from the same set. Variables that resulted in a less-favourable decision by the committee were being at either University 1 or 4, and a more favourable decision was received by candidates who had been on scholarship. Again all the significant regression coefficients were quite small in real terms.

Discussion and conclusions

From the data analysed for this paper, there are a number of variables that are important for completion times for PhD degrees and, taken as a set, these variables explain considerable proportions of the variation in both elapsed time (38%) and candidacy time (22%). The most important variables in both cases are those related to candidature—particularly full/part time enrolment, notifying a problem during candidature, and having a scholarship, with taking leave also important for candidacy time. From these results we could suggest, in a simple world, that providing more scholarships will improve completion times, identifying and attempting to solve problems earlier would help (and perhaps also reduce the need for leave), and allowing a mix of part-time candidature, presumably not on scholarship, would assist with completion times. It is perhaps fortunate that those variables which, at least in theory, are alterable are also those that have the strongest relationships with completion times.

Candidate variables—age, whether a native English speaker, and gender—as another group of variables that are important for completion times, are not alterable. We can recognise some of the complexities of relationships between these variables and others such as discipline area, entry qualification, and nature of enrolment when considering these candidate variables. But, apart from

noting a strong indication that age is not a barrier to completion time and thus probably should not be a factor in research student selection, there is less of use to be learned here.

Relationships between the Broad Field of Study classification used to group discipline areas in these data and completion times suggest a re-evaluation of the common 'wisdom' that science candidates generally take shorter times to complete PhDs than humanities candidates. Although, as a result of being more often part-time candidates, Arts, Humanities and Social Science candidates have a longer elapsed time, these candidates do not have a longer candidacy time than Science candidates. Engineering candidates, who are most often full time, do have longer candidacy times.

There clearly were differences in candidacy time between the six universities involved. The picture is complex with a range of differences between the universities undoubtedly being relevant for completion. For example, universities differed in discipline mix and therefore candidate gender, proportions of full and part time candidature, numbers of scholarship students, policy on taking leave, and proportions of native English-speaking candidates. When the dataset is complete, we intend to undertake further analyses of some of these interesting intersections of candidate and candidature characteristics, discipline area and university of enrolment.

Turning more briefly to thesis quality, it is clear that little explanation of quality, as measured, was possible in the present study. We first need to recognise that, although the committee decision on the thesis does form an ordinal scale which can be considered as a measure of quality, examiner recommendations are less of an ordinal scale, and thus are a weaker approximation to a quality measure. For example, in one case an examiner possibly requires corrections to what he/she considers to be a very good thesis (thus giving the thesis a rating of 3 out of 5) to make it really first rate, while another examiner may accept a thesis without requiring alteration (giving a 'better' rating 4 or 5 out of 5) because he/she does not consider it worth the trouble to improve an acceptable but mediocre thesis. However, that being said, there were many significant explanatory variables (including candidate and candidature variables such as entry level, having a scholarship, age, and notifying a problem), more significantly related to the mean examiner recommendation than variables related to the committee decision.

A postscript

When it is complete, the study reported here will have much more interesting and powerful indicators of thesis quality than 5-category ratings of the examiner recommendation and the committee decision. The complete texts of examiner reports are being coded, based on a scheme consisting of four substantive categories – examiner and process, assessable areas covered, dialogic elements in the report, and evaluative elements, made up of more than 30 sub-categories (see Holbrook *et al.,*, 2001). It is intended that these sub-categories be used to provide detailed, cross-discipline analyses of what is meant by thesis quality and how quality relates to candidate, candidacy and other, more contextual, variables.

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