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The Pedagogy of 'Good' PhD Supervision: A National Cross-Disciplinary Investigation of PhD Supervision

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Executive summary

Background and limitations of the study

Two claims prompted this research. They are:

- a research training environment associated with poor supervision, inadequate levels of departmental support and limited access to quality infrastructure
- high attrition rates and slow rates of completion for research students (bullets in original White Paper, DETYA, 1999, p.2).

These claims mirror growing global investigation into a range of influences on rates and times for research higher degree (RHD) completions in, for example:

- the United Kingdom (Rudd & Hatch, 1968; Phillips 1980; Elton & Pope, 1987; Phillips & Pugh, 1987; Wilkinson, 1989; Wright and Lodwick, 1989; Rudd, 1987, 1990; Burgess 1994; Dunkley & Weeks, 1994; Hockey, 1994, 1995, 1996; Delamont, Parry & Atkinson, 1997, 1998; Pole & Sprokkereef, 1997; Pole, 1998; Wright & Cochrane, 2000; Tinkler & Jackson, 2000; Deem & Brehony, 2000; Haksever & Manisali, 2000);
- Nordic countries (Kyvik & Tvede, 1999; Linden, 2000)
- Australia (Connell, 1985; Moses, 1994; Green & Lee, 1995; Taylor, 1995; Aspland, Edwards & O'Leary, 1999; Dinham & Scott, 1999; Knowles, 1999; Grant & Graham, 1999; Kiley & Liljegren, 1999; Spear, 1999; Bartlett & Merger, 2000; Johnson, Lee & Green, 2000; Latona & Brown, 2001, DETYA, 2001).

Much of the cited literature identifies a relationship between RHD supervision and RHD completions. However, research that specifically investigates PhD completions, times to submission and the influences that give rise to them is limited. The research underpinning this report was therefore designed to add some empirical evidence to the national higher education knowledge base. The research focuses on both individual and institutional influences on PhD completions derived from two sets of data:

- a two-phase national survey of 5450 and 1032 supervisors who supervised PhD candidates over the period 1990–97 in 26 State and private universities across all Australian states and territories
- in-depth face-to-face interviews with 83 PhD supervisors and 26 present or former PhD candidates across 17 universities.

The data provide a limited picture of PhD supervision across Australia. The total number of current PhD supervisors actively engaged in PhD supervision across Australia at the time the research was conducted was unavailable from any source. This probably still is the case and is likely to be a function of inconsistencies between the Department of Education, Science and Education's (DEST) databases, universities' record keeping systems and the statutory reporting obligations of both. There is no requirement that universities report to DEST about some matters noted in this report. The apparent difficulties experienced by some universities in providing whole-of-university contact details for supervisors additionally suggest that some institutions' data collection systems may not readily lend themselves to aggregation.

Further, it is an essential ethical condition of all research involving human beings that participants must participate in the research on a voluntary basis and must be free to

discontinue their participation in the research whenever they wish. The initial intention of the research was to conduct a census of current PhD supervisors across Australia but this ethical condition made it impossible to do so.

Nonetheless, 28 universities participated in the study. Of these, 16 furnished lists of contacts for PhD supervisors that were believed to be complete at the time. The remaining 12 enabled contact with some PhD supervisors in their university and it is likely that the number of supervisors contacted was less than the total number of supervisors currently engaged in PhD supervision within those universities.

The survey included four Go8[1] and 24 non-Go8 universities and two and 14 of these types of universities respectively furnished full lists of contacts. It covered state and private universities in all states and territories. Numerically and in the time-period of the study, this investigation is larger than any research previously undertaken in the area of PhD supervision in Australia.

In addition, the surveys were conducted with the intention of identifying and interviewing supervisors with apparently strong and weak records of PhD completions. Eighty-three PhD supervisors as well as 26 present and former PhD candidates were interviewed across 17 universities, including four Go8 and 13 non-Go8 universities. Supervisors who had fewer than seven completions were excluded from the potential interview sample.

The survey findings about PhD completions and times to submission are similar to the only other Australian findings from research of a comparable national scale (Martin et al, 2001). That study's findings were derived from a different data set, suggesting a degree of diachronic reliability between the figures reported in it and the present study. The present study's findings are also consistent in many respects with domestic and international research literature.

These factors combined represent sufficient grounds for treating the overall data sets as adequate for providing a contribution to understanding supervisory influences that contribute to the timely completion of PhD candidatures.

The report is structured for readability. The summary of findings is followed by the main findings of the research and a concluding section that considers matters arising from the study. Research methods, statistical and interview data overviews are included as separate appendices, with detailed discussion of interview data included in the interview data appendix. A summary of findings is now presented.

Summary of findings

Research cultures

University type and research discipline influence the timely completion of PhD candidatures. However, research discipline has more influence than university type. The PhD candidature appears to be a *rite of passage* into distinct research cultures that manifests in discipline-specific completions and times to submission.

[1] Go8 refers to Australia's eight 'research intensive' universities.

PhD completions

Sixty-four per cent[2] of PhD candidates supervised over the 1990–97 period were conferred with the award of Doctor of Philosophy.

- more Go8 candidates (69%) received the award than non-Go8 candidates (61%).
- comparatively more candidates in the Natural Sciences (75%) received the award than in the Social Sciences (52%), the Humanities & Arts (54%) and Other[3] disciplines (61%).

Times to submission

Sixty-eight per cent of candidates submitted their dissertations for examination:

- 40 per cent submitted in four[4] years or less.
- 57 per cent submitted in five years or less.

A greater percentage of Go8 candidates (73%) submitted than non-Go8 candidates (64%).

- 45 per cent of Go8 candidates submitted in four years or less in comparison with 36 per cent of non-Go8 candidates.
- 64 per cent of Go8 candidates submitted in five years or less in comparison with 54 per cent of non-Go8 candidates.

Comparatively more Natural Science (79%) candidates submitted than in the Social Sciences (55%), the Humanities & Arts (59%) and Other disciplines (64%):

- 48 per cent of candidates in the Natural Sciences submitted in four years or less compared with 30 per cent in the Social Sciences, 28 per cent in the Humanities & Arts and 41 per cent in Other disciplines.
- 69 per cent of candidates in the Natural Sciences submitted in five years or less compared with 44 per cent in the Social Sciences, 46 per cent in the Humanities & Arts and 52 per cent in Other Disciplines.

Associations between research cultures and completions/submission times

Completions and times to submission reflect disciplinary research and publications customs, orientations toward and success in earning external research income, and associations between these factors and supervisors' mean success rates.

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[2] All reported percentages are approximations, because it is possible that individual participants who work in the same organisational element reported supervising the same candidate. In this sense the figures may be over-estimates. However, completion data do not include candidates who were still enrolled at the time of the study and who have since completed or will complete at some time in the future. Similarly, the same caveat applies to a lesser extent for submissions. While full-time candidate submissions are accurate to four years, some part-time candidatures in progress will fall within the four or five full-time equivalent years timeframe if they are completed by 2004 or 2006. In this sense the figures for completions and submissions may be an under-estimates.

[3] Survey respondents self-identified disciplines. Survey and interview data indicate that those who identified as 'Other' disciplines tend to conduct trans-disciplinary research.

[4] All reported submission times are full-time equivalent years.

- Natural Scientific research culture is collaborative in its orientation to the publication of research and is highly oriented and successful in the pursuit of external research income for further research or to fund candidatures.
- Humanities & Arts research culture is individualistic in its orientation to the publication of research and somewhat indifferent and unsuccessful in the pursuit of external research income for further research or to fund candidatures.
- Social Scientific research culture exhibits a blend of Natural Sciences and Humanities & Arts characteristics and orientations, with mixed results.

These factors are associated with supervisors' success rates. In mean terms, supervisors who have been supervising for longer times, have candidates who submit within five years, publish and present papers with present or former PhD candidates, win larger numbers of Australian Research Council (ARC) Large and Small grants, have full-time candidates who do not change supervisors or topics or take leave of absence and examine more PhD theses, have better success rates in terms of timely completions. Supervisors with this profile are found predominantly in the Natural Sciences.

The relative advantages of natural sciences research culture

At least five relative advantages that Natural Sciences research culture affords PhD candidates in comparison with the Social Sciences and the Humanities & Arts additionally explain aggregate disciplinary differences in PhD completions and submission times. Natural Sciences research culture offers:

- a more attainable credential
- more collaborative research support
- more effective levels of stakeholder investment in candidates' success
- safer candidate selection criteria
- a more established supervisory pool.

While individual supervisors' practices tend to reflect their respective research cultures, there are practices that individual supervisors engage in irrespective of university type and across disciplines that can be called 'good' because they contribute to the timely completion of candidatures.

The pedagogy of 'good' PhD supervision

Some supervisors take a 'hands off' approach to supervision that leaves candidates largely to their own devices. Except in a minority of cases where beginning candidates are already self-confident, independent, knowledgeable, skilled, organised and socially adroit, 'hands off' approaches tend to be associated with slow and non-completion.

In contrast, supervisors who are more 'hands on' in their approach to supervision tend to be associated with faster and more completions. The main reason for this is that most commencing PhD candidates do not possess all of the ideal qualities that are often expected as pre-requisites to successfully undertaking a PhD. 'Hands-on' supervisors accept this

situation and their relatively interventionist approach to supervision is more effective than 'hands off' approaches.

Structuring the PhD candidature

The association of 'hands on' supervisory practice with more and minimum time completions is primarily attributable to an interventionist pedagogic approach to supervision. 'Hands on' supervisors actively assist commencing candidates to structure their candidatures. This involves explicitly negotiating with candidates a firm timetable for completing the candidature, especially in relation to:

- available support and project logistics
- institutional quality checks
- project specific milestones such as the production of thesis text
- the presentation and publication of conference and journal papers.

By assisting candidates to structure their candidature, 'hands on' supervisors demystify the PhD exercise. In addition, in the process of structuring the candidature 'hands on' supervisors establish consistent and viable relationships with candidates. An important basis of these relationships is the achievement of early and lasting agreement between supervisors' and candidates' expectations of each other, coupled to action consistent with agreements. Agreement is reached and the relationship maintained by an 'open door' consultation policy combined with supervisors regularly initiating contact with candidates.

In particular, 'hands on' supervisors get to know their candidates well enough for a personal dimension of trust to exist within an otherwise professional relationship. Trust enables supervisors to detect whether and why candidates are experiencing difficulties and thus to make timely and appropriate interventions themselves, or to refer candidates to more appropriate sources of advice and assistance. Trust also enables candidates to approach their supervisors with confidence. 'Hands on' supervisors acknowledge that the supervisory relationship is one of unequal power between supervisor and candidates and use their superior position to mentor candidates' professional development with a view to the candidate establishing him or herself as a peer.

The first year of candidature

The first year of candidature is crucial. During this period 'hands on' supervisors negotiate a mix of formal and informal interactions between themselves, their candidates, other candidates and relevant sources of expert advice. This encourages self-confidence in the candidate and simultaneously monitors progress. Text production is imperative from the outset and is vital throughout the candidature, because it is the basis on which supervisors give advice. In the first year of candidature interactions are of high frequency and entail rapid turnaround of text because candidates require regular and timely feedback to help them to decide whether or not they are making progress and what to do next. 'Hands on' supervisors also encourage candidates to work on more than one task at a time, because this prevents candidates from becoming bogged down by an apparent lack of progress in one area of the research.

Teamwork

'Hands on' supervisors use variations on a generic modus operandi for supervision, namely, teamwork. Teamwork approaches to supervision:

- foster collaborations between candidates via things such as informal coursework and the organisation of candidates into face-to-face and electronic cohorts
- involve academics and other experts additional to the supervisor in candidates' research
- integrate candidates into supervisors' broader associations with research groups and teams as well as industry networks
- enhance the candidate's professional development via activities such as joint preparation of conference presentations and journal papers.

Duration of the candidature

The frequency of interaction between supervisor and candidate then fluctuates during the candidature, tending to decrease at the candidate's discretion as the relationship becomes more like a peer relationship. However, 'hands on' supervisors attach great importance to times of peak candidate activity, especially writing. 'Hands on' supervisors consistently encourage and assist candidates to draft thesis text, and to publish and present their research in journals and at conferences, sometimes by the end of the first year and usually in its second, third and fourth years. 'Hands on' supervisors:

- vary the amount and level of input they provide into theses and publications, providing more input earlier in the candidature and less input later
- go through a number of iterations of thesis and publication drafts with candidates
- negotiate authorship protocols with candidates that reflect the respective contributions made by supervisor, candidate and any additional authors.

Matters for consideration

A number of inter-related considerations about improving PhD supervision and the future of the PhD exercise arise from these findings. At the level of federal policy the main issue is the broad mix of state and private funding and incentives attached to research, the PhD and research training. For universities, the mix of research and non-research degrees on offer, the conventional academic career structure and academic workload are pivotal. As far as research disciplines are concerned, cultural traditions that tacitly govern the conduct of research and PhD supervision within disciplines matter. The capacity of the PhD exercise to meet the demand of the global knowledge economy for rapid knowledge production is an increasingly important concern. These considerations are dealt with in detail in the concluding section.

In order to elaborate these findings, the influence of research cultures on the timely completion of candidatures is now discussed.

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Research cultures

The extract of data below is taken from an interview with a Middle mid-range (MMR) supervisor working in the Humanities & Arts (H&A) on a satellite campus of a non-Go8[1] university. Supervisors' data were categorised into ranges according to supervisors' records of completions, with Middle mid-range referring to supervisors who completed a candidate annually over the 1990–97 time period.[2]

> **MMRH&AS2**: In the academic world that I come from it's been very much the individual. We're not really trained in the Humanities to work as a team.
>
> ***R:*** *Because?*
>
> **MMRH&AS2:** Well, because it's very much an individual---I mean even doing post-graduate work you're on your own. You're creating a new field of your own as a post-graduate and you're out there on your own. I think that's changed---changing---not completely changed. In the hard sciences you're a little cog in a big field and you're working with a team from day one. As a post-graduate you're working with other post-graduates, with research fellows, post-docs and the professor at the head of the big project. So you get a sense of what teamwork is about. In the Humanities you're on your own as an Honours student, you're on your own as a post-graduate student, you're on your own as an academic.

This interviewee has worked in non-Go8 and Go8 universities for over 25 years and has supervised mostly part-time female candidates whose backgrounds and research interests loosely align with the supervisor's research agenda. Many of these candidates are externally enrolled and the supervisor sees them infrequently. Telephone and email contact is sporadic and in the supervisor's view candidates experience difficulty in overcoming what the supervisor perceives as isolation and self-doubt. The supervisor's organisational element is comprised of academics who are themselves PhD candidates and others who have PhDs, and as a Head of School the supervisor is struggling to develop a teamwork approach to research within it.

This supervisor's profile and data extract represent two inter-related differences between how research is undertaken and how PhDs are supervised. One of these differences relates to the national history of overall funding and support for research and the conduct of PhDs that arguably favours Go8 over non-Go8 universities and the Natural Sciences over the Social Sciences and the Humanities & Arts. The second difference relates to disciplinary variations between the research and supervision practices of the Natural Sciences in comparison with the Social Sciences and the Humanities & Arts.

While disciplinary variations must to some extent reflect the national history of research funding and support, they also appear to outweigh the influence of university type. Therefore, the focus of discussion in this and later parts of the report is primarily on associations between disciplinary research and supervision practices and the better aggregate performance of Natural Sciences candidates compared to candidates in the Social Sciences and Humanities & Arts.

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[1] Go8 refers to Australia's eight 'research intensive' universities.

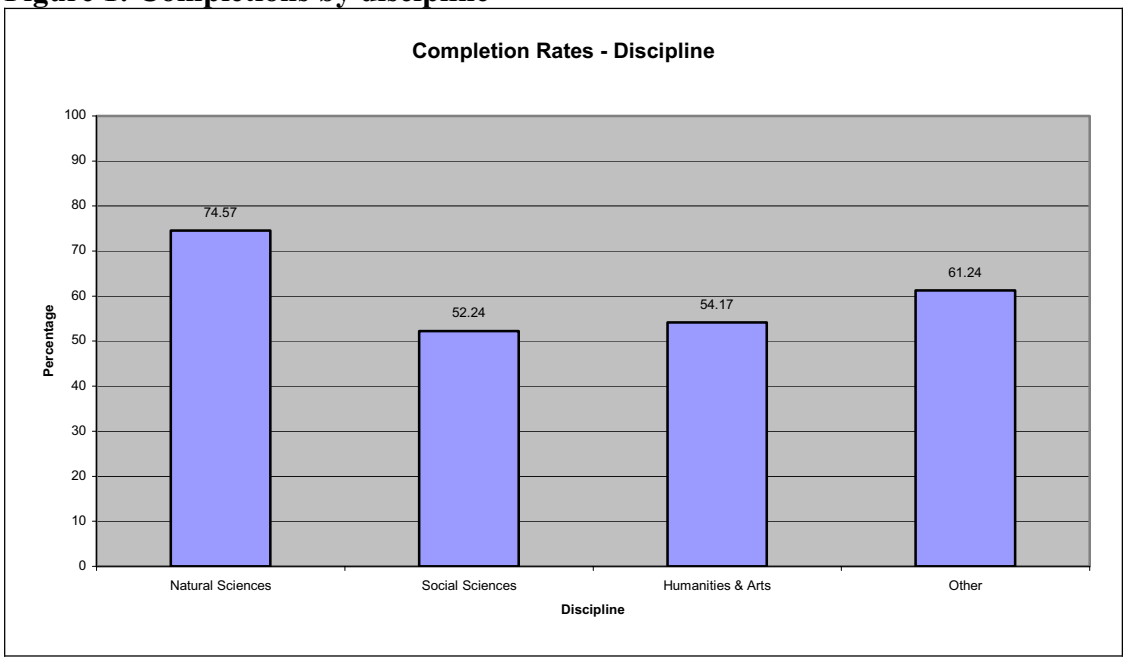
[2] For a full explanation of supervisor ranges, see Appendix 1.

Associations between disciplinary research and supervision practices and PhD completions and submission times

PhD completions

In this sample, approximately 64 per cent of candidates reportedly supervised over the 1990–97 period were conferred with the award of Doctor of Philosophy. More candidates from Go8 universities received the award (69%) than from non-Go8 universities (61%) (see Figure A3). Comparatively more candidates from the Natural Sciences (75%) received the award than from the Social Sciences (52%), the Humanities & Arts (54%) and Other Disciplines (61%) (see Figure 1 below).

Figure 1: Completions by discipline



PhD submissions

Overall, 68 per cent of candidates submitted their dissertations for examination (see Table A2). Fifty-seven per cent of candidates submitted in 5 years or less. 40 per cent submitted in 4 years or less. Fifty per cent submitted dissertations in three to five years.

A greater percentage (73%) of Go8 candidates submitted than non-Go8 candidates (64%). Go8 candidates also submitted in shorter times than non-Go8 candidates (see Figure 3 below). Fifty-seven per cent of Go8 candidates submitted in three to five years compared with 47 per cent of non-Go8 candidates. Submission times greater than five years were similar across university type.

Figure 2: Time to submission—cumulative data by discipline

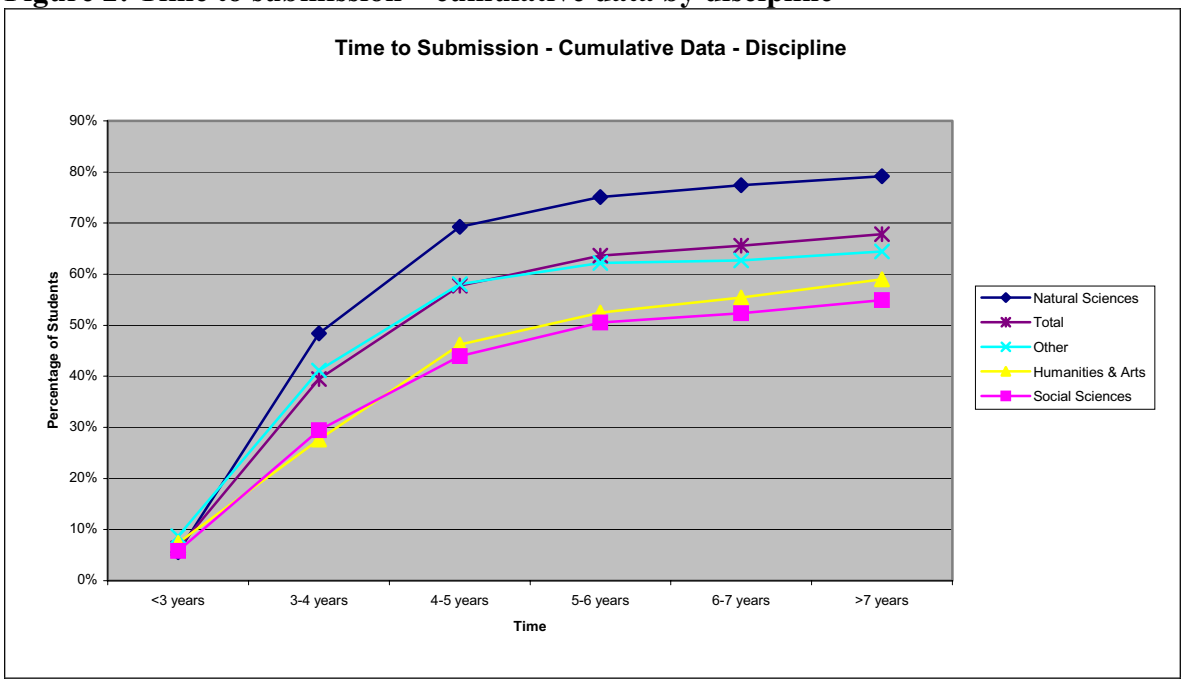
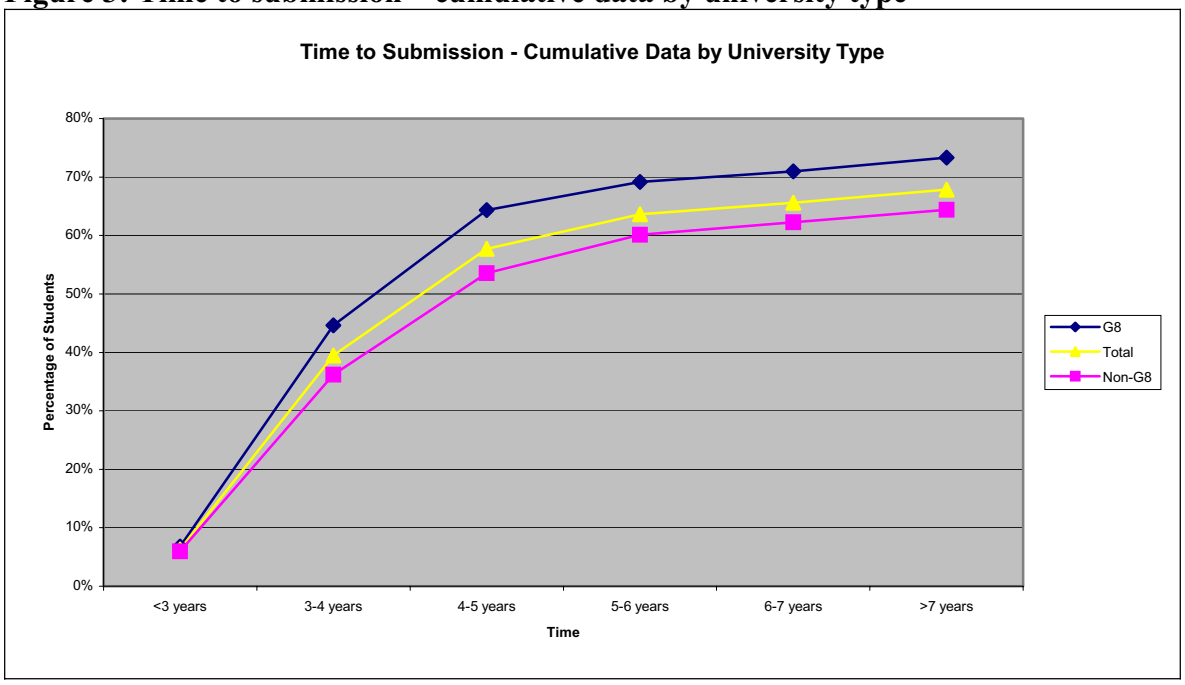


Figure 3: Time to submission—cumulative data by university type



However, a proportionally greater percentage of Natural Science (79%) candidates submitted than in any other discipline. Fifty-five per cent of candidates in the Social Sciences, 59 per cent in the Humanities & Arts and 64 per cent in Other disciplines submitted dissertations (see Figure 2). The three to five year timeframe indicates the extent of disciplinary differences. Sixty-three per cent of Natural Sciences candidates submitted within this timeframe compared to 37 per cent of Social Sciences candidates, 39 per cent of Humanities & Arts candidates and 50 per cent of candidates in Other disciplines. Disciplinary submission times of four years or less were 48 per cent in the Natural Sciences, 29 per cent in the Social Sciences, 28 per cent in the Humanities & Arts and 41 per cent in Other disciplines. The corresponding figures for submissions in five years or less were: Natural Sciences 69 per

cent, Social Sciences 44 per cent, Humanities & Arts 46 per cent and Other disciplines 52 per cent. Submission times longer than five years were similar across disciplines (see Figure 2 above and Table A3).

Comparison of these completions and submissions data suggests that discipline has a greater influence on timely completions than university type. This observation is broadly consistent with an internationally and historically observed trend of disciplinary differences in research higher degree completions (see Rudd & Hatch 1968, NBEET, 1989, Bowen & Rudenstein, 1992, Delamont, Atkinson & Parry, 1997, Pole, 1998, Seagram, Gould & Pyke, 1998, Deem & Brehony, 2000, Wright & Cochrane, 2000). It is further supported by the following analysis of data relating to disciplinary customs for publishing research, pursuing and winning external research income, and, associations between these activities and supervisors' mean success rates.

Disciplinary publications customs

All respondents to the survey had some publications but the number reporting each form of publication (conference papers, journal articles, books, edited collections) varied according to discipline. Mode of publication (single-authored, co-authored, co-authored with present or former PhD candidates) also varied by discipline (see Tables 1 and 2).

Internationally refereed co-authored journal papers are both the publication area of the most respondents and also have the greatest mean number of publications. However, supervisors in the Natural Sciences have three times more of these publications than supervisors in the Social Sciences, and over 10 times as many as supervisors in the Humanities & Arts. Alternatively, books and collections—sole authored or co-authored—were the least favoured methods of publication, both in terms of numbers of respondents who reported them and number of publications. Nonetheless, these publications are most popular in the Humanities & Arts.

If one assumes that books and collections take longer than papers to complete, then comparison of these disciplinary differences suggests that Natural Sciences research culture is geared toward faster means of research publication than is research culture in the Humanities & Arts. Further analysis shows that these and additional disciplinary differences in research publication customs reflect cultural preferences for particular forms and modes of publication within disciplines that are replicated in PhD candidatures, their supervision and completions and times to submission.

In the Natural Sciences, respondents' preferred forms of publication and number of publications in each form are identical. Conference and journal papers are the preferred forms of publication. Co-authorship is the preferred mode of publication. In particular, co-authorship with present and former PhD candidates is prevalent in the Natural Sciences. In this sense the PhD exercise in the Natural Sciences reflects an induction into collaborative research publication customs that is consistent with Seagram, Gould & Pyke's (1998) general observation that collaborating with supervisors on publications contributes to the likelihood of the candidate completing.

In the Social Sciences, respondents were most likely to publish sole authored papers but the greatest quantity of publications per respondent was co-authored. Journal papers are the preferred cultural form of publication in this discipline. Co-authorship is the preferred cultural mode of publication and it sometimes involves PhD candidates.

Table 1: Publications by discipline—percentage of respondents

	Natural Sciences % of respondents	**Social Sciences** % of respondents	**Humanities & Arts** % of respondents	**Other** % of respondents	**Total** % of respondents
Internationally refereed co-authored journal papers	97.31	82.93	48.10	92.36	85.2
Internationally refereed sole authored papers	64.13	85.02	85.44	68.15	73.7
Refereed papers solo presented at international conferences	59.42	74.56	75.32	73.25	68.0
Internationally refereed co-authored papers with present or former PhD candidates	91.48	44.25	16.46	68.79	63.8
Refereed papers co-presented at international conferences	74.22	59.23	29.11	73.25	63.2
Refereed papers co-presented at international conferences with present or former PhD candidates	65.25	36.59	15.82	64.97	49.9
Co-authored books	30.94	54.70	44.94	34.39	40.1
Single-authored books	8.296	44.95	68.35	14.65	28.3
Co-edited international collections	22.42	35.89	32.28	27.39	28.3
Sole edited international collections	7.62	14.98	17.09	12.10	11.7
Co-authored books with present or former PhD candidates	6.95	5.23	5.06	5.10	5.9
Co-edited collections with present or former PhD candidates	4.04	4.53	3.80	4.46	4.2

In the Humanities & Arts, respondents' preferred forms of publication and number of publications in each form were almost identical. Journal papers, conference papers and books are the preferred forms of publication. However, in contrast with the Natural and Social Sciences, sole authorship is the preferred mode of publication in the Humanities & Arts and

co-authorship with candidates is rare. In this sense, as in the Natural Sciences the PhD exercise in the Humanities & Arts reflects an induction into publications customs. Unlike the Natural Sciences, the customary mode of publication in the Humanities & Arts is individualistic as opposed to collaborative. The publications customs of supervisors in 'Other' disciplines are similar to the Natural Sciences.

Table 2: Publications by discipline—mean number of publications

	Natural Sciences mean number of publications	**Social Sciences** mean number of publications	**Humanities & Arts** mean number of publications	**Other** mean number of publications	**Total** mean number of publications
Single-authored books	1.46	19.5	2.15	2.39	1.99
Co-authored books	2.24	3.08	2.42	2.19*	2.58
Co-authored books with present or former PhD candidates	2.03	1.47	1.00	1.38	1.68
Sole edited international collections	2.59	1.98	1.70	1.95	2.08
Co-edited international collections	2.79	2.24	1.71	3.21	2.47
Co-edited collections with present or former PhD candidates	3.61	1.54	1.00	4.86	2.84
Internationally refereed sole authored papers[a]	10.53	11.33	14.05	7.66	11.00
Internationally refereed co-authored journal papers[b]	54.98	17.23	4.16	30.59	36.64
Internationally refereed co-authored papers with present or former PhD candidates[b]	28.30	8.06	2.04	15.65	21.39
Refereed papers solo presented at international conferences	9.92	12.31	10.78	13.63	11.38
Refereed papers co-presented at international conferences[b]	24.89	13.32	3.83	23.58	20.23
Refereed papers co-presented at international conferences with present or former PhD candidates	18.32	9.95	2.40	14.34	15.11

[a]Differences significant at $\alpha = 0.05$
[b]Differences significant at $\alpha = 0.01$

If one takes the view that a significant part of any PhD candidature is learning how to communicate research to one's disciplinary peers at an international standard, then in educational terminology these data suggest that the pedagogy of PhD supervision in the Natural Sciences is the most 'hands on' in this respect because supervisors routinely publish with each other and with their candidates. In contrast, the pedagogy of PhD supervision in the Humanities & Arts seems to be 'hands off' because supervisors publish infrequently with each other and rarely with their candidates.

In turn, given that journal and conference papers are much shorter than books and co-authorship may be a more efficient mode of publication, then it seems the 'hands on' pedagogy of the Natural Sciences additionally inducts candidates into a collaborative modus operandi that is geared toward the production of shorter texts in faster times. Alternatively, the 'hands off' pedagogy of the Humanities & Arts inducts candidates into an individualistic modus operandi that is geared toward the production of longer texts in lengthier times. Social Sciences modus operandi seems to reflect elements of both Natural Sciences and Humanities & Arts research cultures.

These publications practices correspond to the respective forms of PhD theses conventionally submitted in the Natural Sciences on the one hand and the Social Sciences and the Humanities & Arts on the other. The next chapter and the interview data appendix supporting it indicate that theses submitted in the Natural Sciences tend to include or are comprised of research publications while theses submitted in the Social Sciences and the Humanities & Arts are not.

Survey respondents' reported grant and consultancy data indicate additional differences between research cultures that influence the timely completion of PhD candidatures.

Australian Research Council large and small grants, other competitive research grants and consultancies

Tables 3 and 4 show the differences between disciplines for winning Australian Research Council (ARC) Large and Small Grants, other competitive research grants and consultancies. Taken as a whole they indicate that, with the exception of aggregate competitive grants other than ARCs and consultancies, externally funded and larger scale research funding is more frequently won and in larger quantities by researchers in the Natural Sciences than in the Social Sciences and the Humanities & Arts.

The data shed no light on how frequently such funding is pursued and at what rates of success. Thus, this situation may in part be a function of the funding opportunities pursued or available to particular disciplines. Nevertheless, when combined with publications and corroborating interview data these data suggest that:

- Natural Scientific research culture is collaborative and highly motivated and successful in the pursuit of external research funding (including funding for PhD candidatures).
- Humanities & Arts research culture is individualistic and is somewhat indifferent and unsuccessful in pursuing external research funding (including funding for PhD candidatures).
- Social Scientific research culture contains a blend of Natural Sciences and Humanities & Arts characteristics and orientations that produces mixed results.

If one presumes that a significant aspect of PhD supervision involves familiarising candidates with the winning of ARC grants and engaging in competition for external research funding and consultancy opportunities, then these data imply that such learning is most likely to take place among candidates in the Natural Sciences and is least likely to take place among candidates in the Humanities & Arts. In addition, as far as the funding of candidatures via externally earned research income is concerned, the comparatively large numbers of industry-based and industry-partnered candidatures reported among Natural Sciences supervisors and candidates interviewed for the study in contrast with the virtual non-reportage of these

candidatures among supervisors and candidates in the Social Sciences and the Humanities & Arts, reinforces this impression. So too, the candidate and supervisor interview data suggest that the belief is ubiquitous among supervisors and candidates in the Natural Sciences that research and PhD candidatures cannot or should not be undertaken without research income additional to that made available by universities. Apparently, Natural Sciences supervisors frequently augment candidatures with their own external research and consultancy earnings and a minority of Natural Sciences candidates is reliant solely on university funding. While candidates and supervisors in the Social Sciences and the Humanities & Arts similarly believe that university funding for research and PhD candidatures is inadequate, they report candidatures with university funding only are frequently undertaken in these disciplines.

Table 3: Competitive grants by discipline—percentage of respondents

	Natural Sciences % of respondents	**Social Sciences** % of respondents	**Humanities & Arts** % of respondents	**Other** % of respondents	**Total** % of respondents
ARC large grants	55.16	40.07	32.91	34.39	44.6
ARC small grants	71.08	65.51	56.96	54.14	64.9
Competitive/ research consultancy grants	56.05	69.69	32.28	65.61	57.6

Table 4: Competitive grants by discipline—mean number of grants

	Natural Sciences mean number of grants	**Social Sciences** mean number of grants	**Humanities & Arts** mean number of grants	**Other** mean number of grants	**Total** mean number of grants
ARC large grants[a]	5.11	2.59	1.60	3.37	3.90
ARC small grants[a]	4.55	2.76	2.31	3.02	3.57
Competitive/research consultancy grants[a]	10.66	7.24	4.86	8.96	8.75

[a]Differences significant at $\alpha = 0.01$

Thus, if one presumes that the completion of any PhD candidature is to some extent contingent on funding additional to that provided by universities, then the Natural Sciences' competitive orientation and success in the pursuit of additional income implies a greater likelihood of adequate support for candidates. Alternatively, the seemingly indifferent orientation and lack of success of the Humanities & Arts in the pursuit of additional sources of research income implies a lesser likelihood of sufficient support for candidates. It would seem that the fate of candidates in the Social Sciences lies somewhere between that of their counterparts in the Natural Sciences and the Humanities & Arts. Candidates in 'Other' disciplines are more likely to be better supported than candidates in the Social Sciences and the Humanities & Arts. These matters are addressed in more detail in Chapter 2.

The influence of research cultures on timely completions is further reflected by associations between the foregoing and the following discipline-specific data, and, supervisors' mean success rates.

Supervisors' mean success rates

A nominal success rate for supervisors was calculated from survey data as the ratio of the number of candidates conferred with a PhD to the total number of candidates supervised:

$$SuccessRate = \frac{NumberOfCandidatesConferred}{NumberOfCandidatesSupervised}$$

Bivariate correlation showed that the success rate for a supervisor was correlated with the following variables contained in the survey questionnaire (see Table 5 and Appendix 1 for questionnaire).

- Length of supervisory career.
- The submission times of PhD candidates.
- The number of sole edited international collections published.
- The number of internationally refereed journal papers published with present or former PhD candidates.
- The number of internationally refereed co-authored journal papers published.
- The number of refereed papers co-presented at international conferences.
- The number of refereed papers co-presented at international conferences with present or former PhD candidates.
- The number of large ARC grants won.
- The number of small ARC grants won.
- The number of full-time candidates who did not change supervisors.
- The number of full-time candidates who did not change their topic substantially after the first year.
- The number of full-time candidates who completed without taking leave of absence.
- The number of PhD theses examined.

Supervisors' publications activity is highly significant. Supervisors' activities in the publication of sole-edited collections are negatively correlated with completion rates and timely submissions. That is, the more supervisors engage in this activity the greater the likelihood that their candidates either will not complete or will take a long time to submit. Such activity is mostly the province of the Social Sciences and the Humanities & Arts.

Conversely, the following publication activities match the preferred forms and modes of publication of Natural Sciences research culture and are positively correlated with high completion rates and timely submissions:

- co-authoring internationally refereed journal papers
- co-presenting internationally refereed conference papers
- publishing internationally refereed journal papers with present or former PhD candidates
- co-presenting internationally refereed conference papers with present or former PhD candidates.

Moreover, the fourth to second last items in Table 5 referring to full-time candidates are consistent with the pattern of greater numbers of full-time enrolments reported repeatedly at interview by supervisors in the Natural Sciences in comparison with supervisors in the Social Sciences and the Humanities & Arts. These items are also broadly consistent with research literature (Seagram, Gould & Pyke, 1998; National Center for Education Statistics, 1996) that identifies full-time candidature and continuity of enrolment/topic/supervisor as factors that contribute to timely completion.

That this profile is closest to that of Natural Sciences supervisors is further confirmed by analysis of variance which was carried out to determine if there were any differences in the mean success rates of supervisors according to the categorical variables gender, academic designation, discipline and university type. There were no statistically significant differences according to university type (see Tables A37 to A40). Statistically significant differences were found between means for discipline, academic designation and gender. Women had lower success rates and Lecturers' and Senior Lecturers' success rates were lower. Supervisors working in the Natural Sciences had higher success rates.

While nearly half of the sample supervised candidates in the 1990–97 period, 50 per cent commenced supervising prior to 1992. When university type and discipline are taken into account this figure changes with 53 per cent of Go8 respondents commencing supervision prior to 1992 and 57 per cent of supervisors in the Natural Sciences commencing prior to 1992.

Similarly, 85 per cent of respondents had the academic designation of Senior Lecturer or above with small differences across university type; non-Go8 universities had more Senior Lecturers than Go8 universities (see Figure A7). However, there were greater differences within disciplines (see Figure A8). A large percentage of Humanities & Arts supervisors (44%) held the designation Senior Lecturer.

Table 5: Correlations with success rate of supervisors

Question	Pearson's Correlation
How long the supervisor had been supervising PhD candidates	.241[a]
How many submitted their thesis in 4–5 years?	.324[a]
How many sole-edited collections have you published?	-.089[b]
How many refereed journal papers have you published with your PhD candidates?	.212[a]
How many refereed co-author journal papers have you published?	.253[a]
How many refereed papers have you co-presented at international conferences?	.119[a]
How many refereed papers have you co-presented at international conferences with your PhD candidates?	.097[b]
How many large ARC grants have you won?	.161[a]
How many small ARC grants have you won?	.133[a]
Of those conferred between 1990–97 how many did not change supervisors—full-time	.279[a]
How many did not change their topic substantially after their first year—full-time	.296[a]
How many candidates (1990–97) completed without taking leave of absence—full-time	.353[a]
How many PhD theses have you examined	.170[a]

[a]Significant at $\alpha = 0.01$
[b]Significant at $\alpha = 0.05$
Note: This table is duplicated as Table A36

Further investigation shows that the variables listed in Table 5 above are all, with the exception of the number of sole edited collections, correlated with success. This implies that supervisors' success is not simply dependent on these variables. Rather, supervisors' success is a complex artefact of both the protracted academic career structure that is ubiquitous in the data and its association with the norms and customs of discipline-specific research cultures.

Summary

Co-authorship is the preferred mode of publication in the Natural and Social Sciences. Sole authorship is the preferred mode of publication in the Humanities & Arts. Co-authorship with present and former PhD candidates is prevalent in the Natural Sciences, sometimes occurs in the Social Sciences and is rare in the Humanities & Arts. These patterns indicate that disciplinary publications customs are replicated in the context of PhD supervision.

In addition, Natural Scientific research culture is collaborative and highly motivated and successful in the pursuit of external research funding, including for PhD candidatures. Humanities & Arts research culture is individualistic and is somewhat indifferent and

unsuccessful in pursuing external research funding, including for the purpose of funding PhD candidatures. Social Scientific research culture contains a blend of Natural Sciences and Humanities & Arts characteristics and orientations that produces mixed results. These patterns indicate that different levels of support for research in general and for PhD candidatures specifically are associated with differences between disciplines in terms of timely completions.

In particular, there are no statistically significant differences according to university type insofar as associations between supervisors' mean success rates and candidature completions are concerned. Rather, statistically significant differences occur in relation to means for discipline, academic designation and gender. Women have lower success rates and Lecturers and Senior Lecturers who are found in large numbers in the Humanities & Arts have lower success rates. Supervisors working in the Natural Sciences have longer supervisory careers and higher success rates.

The data are inadequate for determining whether supervisor's gender is an effect of discipline. Nonetheless, overall, discipline-specific completion and submission patterns are repeatedly evinced. These patterns suggest that PhD candidatures represent an induction into prevailing disciplinary norms governing the conduct, reportage and supervision of research. In effect, then, the PhD candidature appears to be a *rite of passage* into distinctive research cultures that manifests in different completions and times to submission between disciplines.

The report now examines this situation more closely in terms of five relative advantages that Natural Sciences research culture offers candidates in comparison with Social Sciences and Humanities & Arts research culture.

Five relative advantages of Natural Sciences research culture

Natural Sciences research culture affords candidates at least the five following relative advantages in comparison with the research cultures of the Social Sciences and the Humanities & Arts.

- A more attainable credential.
- More collaborative research support.
- More effective levels of stakeholder investment in candidates' success.
- Safer candidate selection criteria.
- A more established supervisory pool.

A more attainable credential

All supervisors agree that a PhD is an original and substantial contribution to knowledge. However, interview data indicate that there is no trans-disciplinary consensus among supervisors on definitions of substance, originality or their combination. Rather, consistent with Hockey's (1995) findings, different kinds of PhDs are undertaken according to tacit, discipline-specific expectations about the appropriate scope and range of PhD research. This situation tends to make the Natural Sciences PhD more attainable.[3]

To begin with, in the Natural Sciences the PhD topic is often more continuous and pre-determined than is the case in the Social Sciences and the Humanities & Arts. This is because Natural Sciences candidates tend to extend their Honours thesis or extend from a preceding PhD candidates' work or pursue topics that already are part of established university or industrial research agenda. In contrast, in the Social Sciences and the Humanities & Arts, comparatively fewer candidates follow on from Honours, take over a previous candidate's work or undertake research that is closely aligned with established university or industrial research agenda. Rather, the tendency is to pursue more novel, dispersed topics. At the extremity of these differences, the contrast between commencing candidates can be as sharp as that between a Natural Sciences candidate starting with an already determined question versus a candidate in the Social Sciences or the Humanities & Arts taking the first year of their candidature to develop a topic or issue. In more general terms, as Seagram, Gould & Pyke (1998) have pointed out, Natural Sciences candidates tend to make an earlier start on their theses and this is beneficial for completion.

In a related way, the PhD thesis in the Natural Sciences tends to focus more on substance than originality, because Natural Sciences theses tend to be applied to a specific focus. In contrast, the Social Sciences and the Humanities & Arts tend to seek expansive topics. That is, the Natural Sciences PhD makes a contribution to the extant stock of knowledge in concert with numerous similar projects. The Social Sciences and the Humanities & Arts tend to be intent on contributions that border on paradigm changes. Candidates in the Social Sciences and the Humanities & Arts therefore tend to attempt comparatively more ambitious theses

[3] See Appendix 3.1 for a detailed discussion of interview data related to this section of the report.

than their counterparts in the Natural Sciences who generally undertake more confined, manageable theses.

Discipline specific differences between the three common forms that a PhD thesis may take compound this situation. In the Natural Sciences candidates frequently present their theses in one of two forms, namely, a monograph including published research papers or, where university rules allow it, a bound set of research publications. These thesis forms correspond to the observed trend in the survey data of Natural Sciences candidates frequently publishing with their supervisors during the course of the candidature. As the production of papers during candidature implies, these theses tend to be undertaken and written up as a series of discrete tasks that divide the progress of the candidature into self-contained phases. In this sense there is some similarity between these kinds of PhDs and the Professional Doctorates undertaken in the Social Sciences and the Humanities & Arts, the difference being an absence of formal coursework in the former.

In comparison, while the conventional form of Social Sciences and Humanities & Arts thesis is also the monograph the inclusion of published papers in it is unconventional. This is consistent with the noted trend in both survey data and research literature (see for example, Dinham & Scot, 1999) of supervisors in these disciplines publishing less with their candidates. It is further consistent with the common view of most supervisors in these disciplines expressed at interview that publication during candidature distracts candidates from their main task, completing the monograph.

The monograph in these disciplines can also be at least twice the word length of Natural Sciences monographs. Thus, in addition to entailing shorter overall word lengths Natural Sciences theses lend themselves to more rapid, concentrated text production and staged progression than do those submitted in the Social Sciences and the Humanities & Arts.

Moreover, the tacit image of the credentialed graduate implicit in the focus on substance and the forms of Natural Sciences PhDs is that of a ‘trained research scientist’. In contrast, the image of the credentialed graduate implicit in the focus on originality and the form of Social Sciences and Humanities & Arts PhDs is more that of a ‘solo virtuoso’. Candidates in the Natural Sciences are advantaged by this situation insofar as the thesis is required to demonstrate relatively uniform professional qualities in comparison with the degree of individuality and uniqueness expected of theses in the Social Sciences and the Humanities & Arts. Moses (1994) reports that the Australian Vice-Chancellor’s Committee as a contributing factor to completion identified such disciplinary expectations in 1983.

Notably, interview data indicate that High and High mid-range supervisors in the Social Sciences and the Humanities & Arts who involve their candidates in established research agenda and emphasise the substance of the PhD tend to be associated with more and timelier completions than Middle and Low mid-range supervisors in these disciplines whose research agenda are less established or who emphasise the originality of the PhD.

Adding to these disciplinary differences in the PhD exercise, the research support traditionally made available to candidates by Natural Sciences research culture tends to be more collaborative as a matter of course than the research support afforded candidates by Social Sciences and Humanities & Arts research culture.

More collaborative research support

Different 'critical masses' of research infrastructure and support are evident between and within universities at the levels of centralised research bureaus, Co-operative Research Centres (CRCs), university research centres, faculties, departments and schools. No doubt they account for some of the variation between completions and submission times between university types that is not attributable to the influence of research cultures.

However, crucially insofar as the frequency of day-to-day supervision is concerned, candidates in the Natural Sciences traditionally undertake their PhDs as members of a cohort.[4] Conversely, candidates in the Social Sciences and the Humanities & Arts rarely do so. Candidates in the Natural Sciences therefore tend to benefit from regular social and intellectual interactions that are in effect a form of peer supervision that is less available to candidates in the Social Sciences and the Humanities & Arts. This situation is consistent in principle with the persistence enhancing effect of cohorts on candidates identified by Dorn, Papeleris & Brown (1995).

Interview data indicate that High and High mid-range supervisors in the Social Sciences and the Humanities & Arts who informally organise their candidates into cohorts and/or supplement their supervision with informal coursework tend to be associated with more and timelier completions than their Middle and Low mid-range disciplinary counterparts who do not.

In addition, as far as direct supervisory input is concerned, 56 per cent of supervisors reported that face-to-face meetings with their full-time PhD candidates occur at least on a weekly basis (see Table A24). Face-to-face meetings of this frequency are higher in Go8 universities than in non-Go8 universities, especially twice a week interaction (see Table A25).

However, weekly or more frequent meetings occur twice as often in the Natural Sciences in comparison with the Social Sciences, and almost four times more often in comparison with the Humanities & Arts. Similarly, 48 per cent of supervisors in the Natural Sciences reported meeting their full-time candidates at least twice a week, compared with 6 per cent of supervisors in the Social Sciences, 1 per cent of supervisors in the Humanities & Arts and 24 per cent of supervisors in Other disciplines (see Table A26).

A majority of supervisors (56%) reported meeting face-to-face with their part-time candidates at least monthly, with most of this interaction happening between fortnightly and monthly (see Table A27). This interactional pattern is slightly more prevalent in non-Go8 universities than it is in Go8 universities (see Table A28). It is also more prevalent in the Humanities & Arts, Social Sciences and Other disciplines than it is in the Natural Sciences (see Table A29). Alternatively, higher frequencies of weekly and twice weekly interaction are more common in the Natural Sciences.

In turn, a majority of supervisors (55%) reported meeting electronically (telephone / conference, email, internet) with their full-time candidates at least weekly (see Table A30). More than one-quarter reported such interaction at least twice a week. Weekly interactions occur more often in non-Go8 universities, while twice-weekly meetings occur more often in Go8 universities (see Table A31). A similar pattern is evident between disciplines. Weekly

[4] See Appendix 3.2 for a detailed discussion of interview data related to this section of the report.

meetings are most likely to occur in the Social Sciences and the Humanities & Arts. Twice weekly meetings are most likely to occur in the Natural Sciences and Other disciplines (see Table A32).

Again, 42 per cent of supervisors reported that they meet electronically with their part-time candidates on at least a fortnightly basis (see Table A33). The frequency of this level of interaction is greater in non-Go8 universities than it is in Go8 universities (see Table A34). The same applies for Other disciplines, the Social Sciences and the Humanities & Arts in comparison with the Natural Sciences (see Table A35). Electronic contact with part-time candidates on a weekly basis is uniform across disciplines, but twice weekly contact is more prevalent in Other disciplines and the Natural Sciences than it is in the Social Sciences and the Humanities & Arts.

Taken as a whole, these data referring to the frequency of interaction between supervisors and candidates suggest that:

- Interaction between supervisors and full-time candidates in terms of face-to-face and electronic meetings is quite intense in the Natural Sciences and 'Other' disciplines, somewhat evident in the Social Sciences and moderate in the Humanities & Arts.
- To a lesser extent, the same applies to face-to-face and electronic meetings between supervisors and part-time candidates.

Comparison of these inferences with completions and submissions data suggests that frequency of interaction between supervisor and candidate is an important ingredient of PhD supervision that assists the timely completion of candidatures. This is consistent with the view of Seagram, Gould & Pyke (1998), who report frequency of meetings between supervisor and candidate as a factor that contributes to completion and, in a related way, with Aspland, Edwards & O'Leary (1999) who suggest that regular feedback from supervisors has a similar effect.

The effects of frequency of interaction are further consistent with the 'hands on' and 'hands off' pedagogies identified in the previous chapter. The trend for the pedagogy of PhD supervision to be more 'hands on' in the Natural Sciences appears to contribute to the timely completion of PhD candidatures while the tendency for the pedagogy of PhD supervision in the Social Sciences and the Humanities & Arts to be comparatively 'hands off' appears to contribute to proportionally fewer and slower completions in these disciplines.

Many candidates in the Natural Sciences are involved with research groups[5] and research teams because they conduct research that is integral to established agenda. Interview data suggest that the higher frequencies of interaction reported in the survey are attributable to research groups and teams being in constant electronic communication and meeting regularly face-to-face to discuss the progress of broader projects of which candidates' research is a part. Candidates are of necessity involved in such meetings and, consistent with Moses (1994) findings, the overall effect of research team involvement contributes to completion.

In addition, group members also operate in close daily proximity to candidates, because much Natural Sciences research is conducted in laboratories. The greater frequency of interaction between supervisors and candidates is thus in part a function of research group management

[5] Research groups refer to small concentrations of researchers and candidates. Research teams refers to a number of groups.

practice. In part it is also a function of the Natural Scientific laboratory-based research approach of studying phenomena in a controlled environment. For both of these reasons, the research cultures and supervision practice of the Social Sciences and the Humanities & Arts seem to be less managerial than Natural Sciences research culture.

Moreover, the presence of postdoctoral staff is particularly valuable to Natural Sciences supervisors and candidates. Supervisor interviews indicate that postdoctoral staff are not usually recognised as supervising in an 'official' capacity. However, as de facto supervisors they represent an integral source of both supervisory input and day-to-day management of research projects in the Natural Sciences. Candidate interviews indicate that postdoctoral staff are in some cases the primary source of daily advice. Interviews with High and High mid-range Natural Sciences supervisors who lead research groups and teams confirm this and further suggest that the overall duties performed by postdoctoral staff enable these supervisors to devote their efforts to grant applications, reporting on research and tending their research agendas. This indicates a personal motivation for taking on candidates that is consistent with Hockey's (1996) observation that personal benefits influence supervisors to take up supervisory duties that also enhance the likelihood of candidates completing. The next section deals with this and other stakeholder investments in candidatures.

In contrast, with the exception of the High and High mid-ranges of Social Sciences and Humanities & Arts supervision, candidates in these disciplines are typically not involved with research groups or teams on a regular basis and the presence of postdoctoral staff is rare. This relative isolation and absence of additional input contributes to slower progress in comparison with the support available to candidates in the Natural Sciences.

In short, combined with the peer support of fellow candidates and the higher frequency of interaction with official and unofficial supervisors, the cultural habits of Natural Sciences research practice add range, depth and frequency to the 'official' supervisory input and support Natural Sciences candidates receive in comparison with their counterparts in the Social Sciences and the Humanities & Arts.

In particular, the now ubiquitous two-supervisor model notwithstanding, the individual supervisor's load in the Natural Sciences is informally shared irrespective of formal department-, faculty- or university-level protocols. Conversely, individual supervisors in the Social Sciences and the Humanities & Arts especially seem to be more heavily burdened in both the formal sense of 'official' supervisory load and in the sense of having less informal supervisory back-up.

Notably, interview data indicate that High and High mid-range supervisors in the Natural Sciences who lead or are networked with research groups and teams and employ postdoctoral staff are associated with more and timelier completions than Middle and Low mid-range Natural Sciences supervisors who are not. This matter is discussed further in the section immediately below.

Correspondingly, High and High mid-range supervisors in the Social Sciences and the Humanities & Arts who lead or work with research groups or teams and involve their candidates in them are similarly associated in comparison with Middle and Low mid-range supervisors working in isolation in these disciplines.

The dual benefits to candidates of more attainable credentials and more collaborative research support are further enhanced by the levels of investment that various stakeholders have in candidates' success.

More effective levels of stakeholder investment in candidates' success

Interview data imply that the presence or absence of industry stakeholders with investments in candidatures influences the likelihood of timely completion.[6] More specifically, in the Natural Sciences, industry-based[7] and industry-partnered candidatures are common among High and High mid-range supervisors and are characterised by relatively high combined levels of financial and personal investment in timely completion. Partnerships between candidates, supervisors, research groups/teams, CRCs, universities and industry, exert centrifugal force that drives the candidature. Indeed these candidatures resemble consultancies insofar as there is concerted pressure on candidate and supervisor to deliver research outcomes within agreed timeframes. Such candidatures are also evident in 'Other' disciplines. Consistent with the identified association between supervisors' personal benefits and better completions mentioned above (Hockey, 1996), the stakes for supervisors involved in these candidatures can be especially high. Their ongoing external research income stream depends on candidates generating results that contribute directly to the next round of grant applications as well as to the reputation of supervisors, research groups and teams. Natural Sciences supervisors expressed a common view that the candidate reciprocally benefits from the supervisor:

- provisioning part or all of a candidate's scholarship or consumables from external research grants and consultancy monies
- integrating the candidate into research and industrial networks and partnerships
- inducting the candidate into publications and research and grant income winning activities
- conducting professional development about the commercial realities of research
- enhancing the candidate's career prospects, both within and outside the academy.

In contrast, in the Social Sciences and the Humanities & Arts industry-based candidatures are rare and industry-partnered candidatures are less common. Accordingly, many candidates and supervisors in the Social Sciences and the Humanities & Arts do not undertake such candidatures, are comparatively under-resourced, and are under less concerted pressure to complete in short time.

Interview data indicate that High and High mid-range supervisors in the Social Sciences and the Humanities & Arts whose research and candidates are linked to industry tend to be associated with more and timelier completions than their Middle and Low mid-range counterparts who are not.

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[6] See Appendix 3.3 for a detailed discussion of this situation.

[7] The terms 'industry-based' and 'industry-partnered' have been used to differentiate between candidatures that exist as a consequence of supervisors directly approaching industry for funding or vice versa (industry-based), as opposed to partnering with industry in order to win government funds such as is the case with ARC grants (industry-partnered.).

In turn, comparatively lower levels of financial investment characterise university-based candidatures. Unlike industry-based and industry-partnered candidates, non-scholarship university-based candidates are numerous and tend to be more involved in activities outside the conduct of PhD research. Survey as well as supervisor and candidate interview data strongly suggest that these patterns are disadvantageous in terms of timely completion. This is consistent with research literature that deals with this matter specifically (Moses, 1994; National Center for Education Statistics, 1996).

Interview data suggest that supervisors in all disciplines whose supervisory complement is university-based candidatures tend to be associated with fewer and slower completions. More specifically, in the Natural Sciences university-based candidatures are more likely to be undertaken within research groups that are less established and do not employ postdoctoral staff. This corresponds to the situation of Middle and Low mid-range Natural Sciences supervisors. In the Social Sciences and Humanities & Arts, the bulk of candidatures appears to be made up of university-based and candidate-funded/fee-for-service candidatures, which are now discussed.

The narrowest range of stakeholders and amount of investment characterises candidate-funded and especially fee-for-service candidatures, which additionally comprise the bulk of all part-time and external enrolments and are largely undertaken in the Social Sciences and the Humanities & Arts. Candidates either are domestic academics seeking job security or promotion or international candidates undertaking research sponsored by their employer or government. In contrast with industry-based and industry-partnered candidates, these candidates are frequently and heavily committed to activities outside their research that hinder progress. The National Center for Education Statistics (1996) reports a similar situation in relation to students it calls ‘self-funded’, who tend to drop out.

In particular, supervisors who supervise Candidate-funded and Fee-for-Service candidatures experience unique difficulties because:

- Domestic candidates already are career professionals or academics and thus appear to be more like peers than other candidates. In the case of academics, this situation combined with attendant pressures put on supervisors and candidates by universities brings macro- and micro-political tensions to the candidature. To an extent this situation is cultural in origin, because it has been and in some circumstances still is accepted practice in the Social Sciences and the Humanities & Arts to contract and tenure academics who do not possess a PhD.
- The first language of many international candidates is not English and this adds to the time and effort supervisors in all disciplines put into verbal communication and candidates’ written work. Supervisors are additionally burdened both by their knowledge of the distinct linguistic, cultural, familial and professional pressures that international candidates’ circumstances exert on the candidate, and by perceived financial pressures from universities to take on increasing numbers of full-fee-paying international candidates.

The different effects on timely completions of stakeholder investments in candidatures are in turn tied to the safer candidate selection procedures employed in the Natural Sciences in comparison with the Social Sciences and the Humanities & Arts.

Safer candidate selection procedures

Eighty-five per cent of candidates who were reported as scholarship holders by survey respondents were conferred with a PhD (see Table 6). Scholarship holders represented 87 per cent of Natural Science conferrals, 84 per cent of Social Science conferrals, 79 per cent of Humanities & Arts conferrals and 90 per cent of conferrals in Other disciplines. 85 per cent of Go8 candidates who were scholarship holders and 86 per cent of non-Go8 candidates who were scholarship holders were conferred with a PhD.

Comparison of these disaggregated data with aggregate completions data suggests three things:

- across university types and disciplines the likelihood of completion is enhanced by possession of a scholarship
- non-Go8 candidates derive greater benefit from possession of a scholarship than Go8 candidates
- candidates in the Social Sciences, Humanities & Arts and Other disciplines derive greater benefit from possession of a scholarship than candidates in the Natural Sciences. This proposition is counterfactually consistent with Moses' (1994) conclusion that less financial worry contributes to Natural Sciences' candidates greater rates of success.

In addition, full-time candidates are more likely to complete than part-time candidates (see Table A12). Full-time candidates are also more likely to complete in circumstances where they do not:

- change supervisors
- change their topic after the first year of candidature
- take leave of absence.

Thus, financial security plus conceptual and temporal continuity of candidature and supervision contribute to the likelihood of completion. This effect holds across university types (see Table A13), disciplines (see Table 6), and is consistent with national and international findings related to these factors (Seagram, Gould & Pyke, 1998; Moses, 1994; National Center for Education Statistics, 1996).

Crucially in terms of candidate selection, scholarship and full-time candidatures are more prevalent in the Natural Sciences. Indeed interview data suggest that many of the part-time candidates reported in the survey by Natural Sciences supervisors are probably full-time candidates who over-run their scholarships.

Table 6: Comparison of full- and part-time candidatures by discipline—percentage of students

	Natural Sciences		Social Sciences		Humanities & Arts		Other	
	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time
How many of the PhD candidates that you supervised over the period 1990–97 held candidatures that were predominantly	71.64	28.39	48.25	51.75	52.7	47.26	59.5%	40.50
Of those who were conferred, how many candidates were	70.44	29.56	51.61	48.38	54.5	45.45	61.0	38.96
Of those conferred between 1990–97 how many did not change supervisors	69.77	30.23	50.77	49.23	53.6	46.40	59.5	40.50
How many did not change their topic substantially after their first year	69.91	30.09	51.01	48.99	53.8	46.15	59.6	40.34
How many candidates (1990–97) completed without taking leave of absence	70.58	29.42	52.91	47.09	55.3	44.67	60.2	39.80
How many candidates (1990–97) were scholarship holders	67.52	32.48	53.42	46.58	52.0	47.98	59.2	40.71

Note: This table is duplicated as Table A14.

In addition, interview data indicate that Natural Sciences supervisors tend to turn away prospective candidates who wish to pursue research unrelated to their own agenda or do not hold a scholarship or wish to enrol part-time. Conversely, these sorts of candidates are sought after in some areas of the Social Sciences and the Humanities & Arts, are more prevalent in these disciplines overall and represent almost the full supervisory load of some supervisors. The contrast between disciplines in terms of candidate selection can be as distinct as the difference between the approach of some High and High mid-range supervisors in the Natural Sciences who make no accommodation for a prospective candidate's area of interest on the

grounds that it does not fit their own agenda and is not financially supported, compared to the practice of some Middle and Low mid-range Social Sciences and Humanities & Arts supervisors who accept all comers irrespective of fit between their own personal area of expertise and the candidate's particular area of interest.

This situation appears to be in part a product of reportedly heightened associations between academic career advancement and increased supervisory duties. Supervisors from all disciplines commented on the value of supervision in terms of academic employment and promotion and the heightened interest of universities in garnering as many research candidates as possible. To some extent the situation also reflects the circumstances governing the allocation of scholarship places. Universities allocate scholarship places according to various weighted criteria and formulae that involve the rank ordering of scholarship applicants. Invariably there are more applicants than scholarships and the emotion surrounding scholarship allocations is so high and the intra- and inter-disciplinary rivalry for scholarship places so intense that it is impossible to separate from the interview data what supervisors believe about the actual formulae that universities apply and their perceptions of fairness.

These matters notwithstanding, there is a discernible preference within the Social Sciences and the Humanities & Arts to select candidates on the basis of prior experience that is deemed equivalent to academic and research-related qualifications. The underlying presupposition seems to be that a candidate's personal and professional experience is equivalent to the capacity to undertake research. Therefore, specific employment or experience in research does not necessarily come into selection considerations in these disciplines. In contrast, in the Natural Sciences, equivalence to academic qualifications is deemed to be employment experience in a research-specific position such as a research assistant. Thus, the cultural criteria underpinning academic equivalency for the selection of candidates in the Natural Sciences favour the selection of candidates with some proven background in research. This is less the case in the Social Sciences and the Humanities & Arts.

This situation is mirrored by the academic criteria employed for selecting PhD scholarship candidates. In the Natural Sciences for some time it has been rare for anything less than a First Class Honours to be considered adequate as an academic selection criterion for university scholarship places, although supervisors who fund scholarships from their own winnings occasionally fund candidates with a Second Class Honours Division A (2A). In contrast, interview data indicate that until quite recently in the Social Sciences and the Humanities & Arts 2A Honours results were awarded scholarships more often than in the Natural Sciences, with the practice being discontinued across universities now.

Additionally, in the Natural Sciences Research Masters degrees are commonly accepted as an adequate academic selection criterion in comparison with coursework Masters degrees. While Research Masters degrees are considered in selections in the Social Sciences and the Humanities & Arts, Masters Coursework degrees are accepted as an adequate selection criterion, subject to some caveats. This was noted by Moses (1994) who argued that assuming the 'equivalency' of a coursework Masters to a good Honours degree can be a mistake.

Moreover, the interview data indicate a growing trend in the Natural Sciences toward the inclusion of research publications as an academic criterion for scholarship places. Supervisor and candidate interview data suggest that it is not uncommon for Honours and Masters level Natural Sciences candidates to publish during or immediately after these candidatures. In

comparison, this is uncommon in the Social Sciences and the Humanities & Arts. Indeed a record of a few research publications is more commonly viewed in these disciplines as appropriate for applying for an academic position.

The criteria for the selection of PhD candidates employed in the Natural Sciences are closely tied to the conduct of research. Selection criteria in the Social Sciences and the Humanities & Arts tend to be less research-specific.

Interview data indicate that High and High mid-range supervisors in the Social Sciences and the Humanities & Arts supervise predominantly part-time and externally enrolled candidates who do not necessarily hold scholarships or have academic or equivalent qualifications, yet these supervisors still are associated with more and timely completions because they do one or more of the following:

- Emphasise the substance of PhDs more than their originality.
- Organise their candidates into face-to-face and electronic cohorts, including the use of informal coursework.
- Lead or are members of research groups or teams and involve their candidates in them.
- Are networked with industry.

The circumstances surrounding the selection of candidates cohere with the more established supervisory pool available to candidates in the Natural Sciences.

A more established supervisory pool

Interview data indicate that there is great similarity between disciplines in relation to supervisor training. None of the supervisors interviewed for the study had received any formal training in supervision prior to taking up supervisory duties. Rather, all learned their supervisory knowledge and skills informally, on-the-job, which is consistent with Dinham & Scot's (1999) finding that the provision of supervisor training is ad hoc. Although interview data indicate that universities and their organisational elements are now replete with supervisor training initiatives, this phenomenon's newness makes it impossible to discern from the data their efficacy or otherwise.

However, the extent of supervisory knowledge and experience acquired informally within disciplines is consistent with survey data that have already been presented in the previous part of this report highlighting the association between disciplinary differences in length of supervisory career and different completions and submission times. Interview data further suggest that in the Natural Sciences it is common for PhD graduates to undertake at least one postdoctoral appointment prior to gaining an academic position. Postdoctoral appointments represent an informal training ground for undertaking larger scale collaborative research and for research higher degree supervision. Thus, as an effect of Natural Sciences career structure supervisors serve an informal apprenticeship that is largely absent from the career structure of academics in the Social Sciences and the Humanities & Arts. Indeed it seems that on occasions quite senior academics in the latter disciplines take on supervisory duties without having completed a PhD themselves.[8]

[8] Two Low mid-range supervisors, both Professors working in Go8 universities, attested to this situation.

Moreover, survey data identified a penchant for publication and the winning of external research income in the Natural Sciences. It is likely, then, that in addition to informal research and supervisory experience Natural Sciences supervisors bring comparatively established research publication and income winning practice to their first officially recognised supervisory situation. This breadth and depth of prior research experience is less likely among academics in the Social Sciences and the Humanities & Arts before they commence supervisory duties.

Summary

In terms of stage of thesis question/topic development, the starting points of commencing candidates in the Natural Sciences versus the Social Sciences and the Humanities & Arts tend to be staggered in favour of Natural Sciences candidates. Candidates in the Social Sciences and the Humanities & Arts additionally tend to attempt comparatively more ambitious theses than their counterparts in the Natural Sciences. Natural Sciences candidates are also required to meet more uniform professional criteria compared with the criteria of originality and uniqueness expected of Social Sciences and Humanities & Arts candidates.

Candidates in the Natural Sciences traditionally undertake their PhDs as members of a cohort. Candidates in the Social Sciences and the Humanities & Arts rarely do so. Interaction between supervisors and full-time candidates in terms of face-to-face and electronic meetings is quite intense in the Natural Sciences and 'Other' disciplines, somewhat evident in the Social Sciences and moderate in the Humanities & Arts. To a lesser extent, the same applies to face-to-face and electronic meetings between supervisors and part-time candidates.

Candidates in the Natural Sciences tend to be involved in candidatures involving higher levels of stakeholder investment and greater pressure to complete. Across university types and disciplines, the likelihood of completion is enhanced by possession of a scholarship, full-time candidates are more likely to complete than part-time candidates, and, full-time candidates are more likely to complete where there is financial, conceptual and temporal continuity of candidature and supervision. These conditions are most likely to be fulfilled in the Natural Sciences, where supervisors are reluctant to supervise non-scholarship or part-time candidates and such candidates comprise a small minority of Natural Sciences candidatures overall. Conversely, these sorts of candidatures are sought after in some areas of the Social Sciences and the Humanities & Arts, are more prevalent in these disciplines overall and represent almost the full supervisory complement of some supervisors.

The cultural presuppositions underpinning academic and equivalency criteria for the selection of candidates in the Natural Sciences are more geared toward selecting candidates with some proven background in research than is the case in the Social Sciences and the Humanities & Arts. Similarly, as an effect of Natural Sciences career structure supervisors serve an informal apprenticeship that is largely absent from the career structure of beginning supervisors in the Social Sciences and the Humanities & Arts. Commencing Natural Sciences supervisors are also more likely to bring established research publication and income winning experience to the supervisory situation.

Notably, supervisors in the Social Sciences and the Humanities & Arts who involve their candidates in established research agenda and emphasise research training and the substance of the PhD tend to be associated with more and timelier completions. Supervisors in these disciplines who informally organise their candidates into cohorts or supplement their supervision with informal coursework tend to be associated with more and timelier

completions. Supervisors in the Social Sciences and the Humanities & Arts who lead or work with research groups or teams and involve their candidates in them are likewise associated. The same applies to Social Sciences and Humanities & Arts supervisors whose research and candidates are linked to industry. In particular, all of these factors hold in the case of part-time rather than full-time candidates alone.

Comparison of these similarities with differences between disciplines suggests that although the practices of individual supervisors reflect their respective research cultures, there are some generic supervisory practices that are associated with timely completions and there are others that are not. These differences relate to the degree of interventions in candidature characterised in this and the preceding chapters as ‘hands on’ and ‘hands off’ pedagogies.

The pedagogy of 'good' PhD supervision

The idea that PhD supervision is a form of 'pedagogy' is not universally accepted (see Green & Lee, 1995, 1999; Knowles, 1994; Taylor, 1995). Nevertheless, following Bernstein (1977, 1990, 1996), 'pedagogy' can be defined generically as the how of teaching which in turn translates as how to supervise. From this perspective, cross-disciplinary similarities between supervisory practices and procedures that are associated with more or less and faster and slower completions suggest that the pedagogy of PhD supervision can be described as an 'intervention continuum', ranging from 'hands off' to 'hands on'.

'Hands off' versus 'hands on' supervision

At the 'hands off' end of the continuum, supervisors intervene minimally in the candidature and fewer and slower completions tend to result. At the 'hands on' end of the continuum, supervisors and others regularly intervene in the candidature and more and faster completions tend to follow.

While 'hands off' supervision is more characteristic of the Social Sciences and the Humanities & Arts, some Natural Sciences supervisors are of a similar persuasion. A clear example is a Low mid-range Natural Sciences supervisor who for at least two reasons could be called a critic of the Natural Science 'hands on' supervisory tradition:

- This supervisor takes on only candidates who are doing research that is not directly related to the supervisor's. It is the supervisor's belief that the Natural Scientific ritual of supervising candidates whose research interests closely coincide with their supervisor's is open to abuse. Some supervisors in his view use it as a way of getting candidates to do their research for them.
- The supervisor will not publish with candidates, because this practice borders on 'parasitism' in the supervisor's view.

This supervisor is aware that because of this ethical stance candidates often experience difficulties that other candidates in the Natural Sciences and the supervisor's field conventionally do not. Thus, while more candidates either do not or take longer to complete than is usual in the Natural Sciences, in the supervisor's view candidates that complete are better quality researchers because they are highly independent and have a flair for originality.

Similarly, High-range, and High and Middle mid-range supervisors in the Social Sciences and the Humanities & Arts employ pedagogies that are more 'hands on' than this supervisor and supervisors within their disciplines who are more 'hands off'. These supervisors actively integrate their candidates into their own research networks and agendas, informally institute coursework, develop cohorts of candidates and co-author with their candidates.

There are quality implications attached to both 'hands off' and 'hands on' pedagogies. On the one hand, under 'hands off' pedagogy candidates who complete do so largely as a result of their own efforts. Thus, if quality is taken to mean the production of highly independent, self-reliant researchers, then 'hands off' pedagogies can lay claim to facilitating this result. Indeed the comparatively low completions and lengthy submissions associated with 'hands off' pedagogies could be interpreted as evidence of their quality, an interpretation that is consistent with the Moses (1994) finding that candidates undertaking research in disciplines that have expectations of high autonomy on the candidate's part have high drop out rates.

Alternatively, 'hands on' approaches can equally be interpreted as providing quality if quality is taken to mean an aggregate output of trained researchers that is collaborative in practice, congenially disposed to competing for external research and industry income, rapid and continuous in the conduct and publication of research and competent in undertaking comparatively applied and specifically focused research projects. However, while in and of themselves these concepts of quality are meaningful, the interview data indicate that there is a practical dimension of quality supervision that refers to the situation of commencing candidates which cannot be ignored.

Commencing candidates

The majority view expressed in interviews by supervisors from all disciplines is that most commencing candidates (including scholarship holders) tend to lack one or more of the following qualities:

- independence and confidence
- broad or specialist theoretical knowledge
- competence with broad research methods or specialist techniques
- the ability to design research within feasible conceptual, methodological and temporal parameters
- the ability to construct and sustain a logical argument
- technological literacy (knowledge and skills)
- the ability to write in clear comprehensible English (domestic and international candidates)
- life and organisational skills adequate for juggling the competing demands of research and the financial, personal and social dimensions of life
- social skills associated with team-building and networking.

If this perception is the case, then the association of 'hands off' and 'hands on' pedagogies with completions is more explicit. 'Hands off' pedagogy presupposes that commencing candidates ought to be self-reliant. However, it appears that most commencing candidates are in need of greater assistance than 'hands off' pedagogy admits. This partly explains why 'hands off' approaches tend to be associated with slow and non-completion, other than in the case of exceptional candidates. In contrast, the ideal qualities that are implicitly expected as pre-requisites by 'hands off' pedagogic approaches to PhD supervision are less taken-for-granted by 'hands on' approaches. 'Hands-on' supervisors expect that a relatively interventionist approach to supervision is necessary. Indeed some 'hands on' supervisors acknowledge that even exceptional candidates still require some intervention insofar as over-confidence can be as counter-productive as lack of confidence.

In addition, it is the case that the extent of intervention that 'hands on' supervisors exercise differs. For example, a High-range supervisor working in the Natural Sciences in a Go8 university personally introduces new PhD candidates to staff and PhD candidates within the research team, other research elements and to university staff associated with candidates' research such as research office staff and librarians. This supervisor's account of induction activities was corroborated by interviews conducted with three PhD candidates who spoke highly of this and other of the supervisor's practices, including an 'open door' policy of

availability, same-day or overnight text turnaround and regular formative and substantive assessments of their progress. These supervisory practices are directive and explicitly performance-oriented in comparison with the self-reliance and competence tacitly presumed of candidates by 'hands off' pedagogy.

A less interventionist but nonetheless 'hands on' pedagogy is that employed by a High-range supervisor working in the Social Sciences in a Go8 university. This supervisor practices a 'partnership arrangement' with candidates, based on an 'equity principle' that involves candidates becoming aware of options so that they can make informed decisions about how their candidature will proceed. This supervisor was the only one in that discipline group who supervised the 'bound set' form of PhD thesis. In response to the question, *'in your field, it's the presentation of a monograph, not a series of published papers?'* the supervisor replied, *'could be either. The regulations of this institution allow it and the practices in this faculty allow it.'* The supervisor was then asked, *'And what about your practice?'* and replied:

> **HRSS2**: Yes, of course. It's a relationship with equity. I mean, that's not the sort of thing I'd be wanting to make decisions about for a student. I'd be wanting the student to make informed decisions as a result of what I was able to help them be informed about.
>
> ***MS**: So in the initial stages of the candidature you would tell the student it may be that you will do the PhD in the form of publications. It may be that it will be a monograph but we'll work that out as we go?*
>
> **HRSS2:** Yes. It's very likely to be one and not the other. I mean PhD's through publications don't apply to most people. But it's part of understanding what the process is and what the nature of the PhD is. People need to have some awareness about it.

This supervisor's pedagogy is less directive than the previous example, and this supervisor reiterated throughout the interview that the degree of intervention is tempered in accordance with the specific wishes of individual candidates. This approach is consistent with supervisor and candidate interview data indicating that 'hands on' supervisors deal with candidates on a case-by-case basis rather than assuming that all candidates will require extensive intervention, or almost no intervention as is the case with 'hands' off' pedagogy. Similarly, because High and High mid-range supervisors tend to supervise comparatively large numbers of candidates at any one time, it is likely that some candidates will require more assistance than others. In this particular supervisor's case, as well as apprising candidates of their options the supervisor sometimes but not always augments personal supervision with informal supervisory teams. The supervisor is also active within a national network of professionally associated researchers and integrates some but not all candidates into this network via this association's annual postgraduate conference. These sorts of interventions, voluntarily entered into by candidates on an informed basis, relate to what this supervisor sees as a responsibility to assist candidates' academic development.

> ***R**: What does supervision mean to you? What does a supervisor do?*
>
> **HRSS2**: Ah, what's a supervisor do? Okay. A supervisor works with students in this shifting form of equity that I've already talked about with the intention that the students will very rapidly outstrip them in terms of the detailed understanding of the specifics of the area in which the research project is occurring, with the intention that they will assist me in keeping up to date with a range of literatures, with the intention that I will assist them by helping them move into a range of aspects of the academy. I will help them go through the process of writing and giving research papers, forming networks at conferences, reviewing papers.

***R**: Getting research grants?*

HRSS2: That depends. Where possible, yes.

Assisting candidates to learn the processes of writing, presenting research papers, forming networks and developing research grants is undoubtedly helpful, but this supervisor only engages in such activity with candidates who desire it. Nonetheless, in these particular cases the supervisor's pedagogy is relatively interventionist in comparison with the approach of 'hands off' supervisors.

Further illustrating the contrast between these 'hands on' examples and 'hands off' pedagogy is the 'hands off' pedagogy of a Low mid-range supervisor working in the Social Sciences in a Go8 university. Over more than 20 years it has been this supervisor's habit early in the candidature to encourage candidates who are not highly independent or well organised to seek out another supervisor. In this supervisor's view, it is not incumbent on supervisors to 'hold their hands'. For example, while the supervisor insists on the production of text in advance of meetings, when this supervisor reads the text only substantive verbal as opposed to written comments are raised with the candidate at the meeting. Similarly, if a candidate fails to produce text, misses two scheduled meetings consecutively, or turns up unprepared, this supervisor takes these occurrences to indicate a lack of independence. Three missed or unprepared meetings confirm the pattern.

> **LMRSS3:** They have some idea in their minds that the PhD goes from here to there and it should be done by them. But then they come in and say 'writing's being done but I've got these problems'---One has failed to produce something in the first three sessions. The next session is going to be quite brutal where I say, 'You're giving me shit for excuses. I'm tired of this. If that's you're general pattern you may find another supervisor.'
>
> ***R:** So you make a decision to cut students loose fairly early?*
>
> **LMRSS3**: Yeah. I confront them with what they're doing because if they're not going to change that - it's no credit to me to drag them up. Some people think so.

Comparison of this 'hands off' approach with the preceding variations on 'hands on' supervision highlights differences between the levels of confidence and independence expected by supervisors of commencing candidates on the one hand, and the amount of intervention or help that supervisors believe it is appropriate for them to provide on the other. The first 'hands on' example indicates that beginning candidates may require considerable assistance. The second 'hands on' example indicates that more or less assistance is warranted on a case-by-case basis. The 'hands off' example indicates that a minimum of assistance is appropriate. These differences in pedagogic principle and their effects are further evinced by comparison of 'hands on' supervisory intervention in assisting commencing candidates to structure their candidatures in contrast with the absence of such intervention in the case of 'hands off' pedagogy.

Structuring the PhD candidature

'Hands on' supervisors in comparison with 'hands off' supervisors actively assist commencing candidates to structure their candidatures. To begin with, commencing candidates tend to find the PhD exercise confronting and mysterious and all supervisors describe this situation in terms of commencing candidates' lack of confidence. However, 'hands on' supervisors' deliberate strategy of assisting candidates to structure their

candidature has the effect of demystifying the PhD exercise and to some extent allays commencing candidates' self-doubt.

More specifically, at the beginning of the candidature 'hands on' supervisors demystify the PhD exercise by explaining to candidates:

- their own expectations
- the progress of the candidature in relation to standardised institutional quality checks employed by universities and their organisational elements such as faculties, departments and schools
- relatively uniform stages of candidature progression marked by the generation of thesis text and sometimes the publication of refereed conference and journal papers.

In addition, 'hands on' supervisors map these expectations onto available supervisory support for the candidature, especially the involvement of sources of advice other than the supervisor. The logistics of the research, particularly the availability of time, resources and funding at pertinent points in the future, are also plotted in advance, sometimes via the use of gant charts.

In contrast to making interventions such as these, 'hands off' supervisors tend to direct candidates to available sources of information such as university handbooks and/or administrative staff, with the expectation that the candidate will determine their own course for the candidature. These different expectations that 'hands on' versus 'hands off' supervisors have of candidates highlight the importance of the first year of candidature.

The first year of candidature

'Hands on' supervisors use the first year of candidature to develop the personal dimension of the supervisory relationship and to develop collaborations between themselves, the candidate and others. As far as developing the personal dimension is concerned, the key ingredient is trust.

Trust is illustrated in the data sample below, taken from an interview with a former PhD candidate. This candidate's profile stands in contrast to survey data indicating low completions for part-time candidates. The candidate was enrolled as a part-time candidate while a full-time academic and completed the candidature in the Humanities & Arts in four years, which translates as two years full-time equivalent. Much of the credit for this achievement must be the candidate's, but the candidate *'kept in regular contact … [with the supervisor, and] … if there was ever a time when … [the candidate] … needed to meet with … [the supervisor] … that was not scheduled, nine times out of 10 … [the supervisor] … made time … That was a sort of sign of sincerity to … [the candidate. It indicated] … not just a commitment to the topic but to the responsibility of being a good supervisor*'.

This candidate's words highlight the importance of supervisors having an 'open door' policy. They also cohere with common sentiments expressed by candidates from all disciplines in response to the question *'what makes a good supervisor?'* This candidate's data emphasise *sincerity* and *responsibility* as key ingredients of good supervision. Similar terminology that other candidates frequently used to define good supervision included availability, approachability, honesty, reliability, consistency and respect for candidates, which combined engender trust.

In turn, the extension of trust to collaborative arrangements is illustrated by two data extracts below. The extracts are taken from an interview with a High-range supervisor who identified as working in 'Other' disciplines. This supervisor's research agenda and network are trans-disciplinary, integrating discipline areas and disciplines. The supervisor works in a Go8 university. Survey data indicate that over the 1990–97 period 22 full- and four part-time candidates (26 in all or seven every two years on average), were supervised with 100% completion.

Like 'hands off' supervisors this supervisor values independence in candidates, because *'as future research scientists they need to be able to conceptualise and solve problems themselves'*. However, independence does not mean working alone. This supervisor expects candidates to work together, to work with postdoctoral staff and to work with other academics. In this sense the supervisor's pedagogy is quite directive. The supervisor first informs prospective candidates that this is what is expected of them. Prospective candidates are then advised to speak with others of the supervisor's candidates about how the supervisor and the research group operate. If the candidate signs on, the supervisor's expectations are repeated clearly at the first meeting. Interviews with three of this supervisor's candidates corroborate that this is habitual. Indeed this supervisor's pedagogic approach was known to two of them before they embarked on their candidatures and influenced them to do so. All three candidates described as beneficial the supervisor's practice of including candidates in trans-disciplinary networks, illustrated below:

> **HROS1**: The last meeting we brought in a … [type of] … chemist because there were some aspects that involved … [that type of] … chemistry. Next meeting I've lined up a statistician in … [a type of] … nutrition who's going to join us and talk about some of the data and information that she … [the candidate] … will be collecting. The next session we want to talk about some of the issues related to the data analysis and some of the tools that need to be picked up for that.

These data show how this supervisor deliberately draws expert conceptual and technical input from related research fields outside the supervisor's immediate area of expertise, in order to assist candidates to frame and develop their research. They show how 'hands on' direction of the candidature assists in structuring it from the outset.

The extract below shows how these structured collaborations develop candidates' confidence and trust.[9] The researcher asked '*So by and large what you're doing is getting the logistics of the project nailed down?*' and the supervisor gave reasons why research collaborations are routinely developed early in the candidature.

> **HROS1*:*** Yep, but at the same time that you introduce the student to the people who have expertise you introduce them at a level the student is comfortable with … [the candidate] … now knows the chemist. After this next session … [the candidate will] … know the statistician … [The candidate] … knows them enough that … [the candidate] … feels sufficiently at ease with them and understands what they can do, so … [the candidate] … can follow up and talk to them in the future.

The first sentence above emphasises the need for collaborations to target candidates' intellectual and inter-personal relationship needs simultaneously. The extract shows how

[9] See Appendix 3.4 for additional data bearing on the relationship between research collaborations and the development of trust.

introducing the candidate to other sources of advice than the supervisor assists the candidate's knowledge development. It shows how this strategy can encourage a trusting disposition toward ongoing consultation in the candidate. Although the supervisor's intervention in the candidature is one step removed from the candidate, it structures the candidature in a way that establishes trust.

The foregoing illustrations of 'hands on' supervision show how it assists candidates to structure candidatures and develop trust in the process. 'Hands on' supervisors additionally deploy strategies at various stages of candidature that address comparatively common problems that arise in most candidatures.

'Hands on' strategies for addressing common problems

The potentially corrosive affects of candidates' lack of confidence are inhibited by 'hands on' supervisors negotiating small, achievable tasks and milestones with candidates at the beginning of candidature. This can be as simple as beginning with dot points. As the candidature progresses, the strategy involves the negotiation of larger, more significant milestones, such as the development of a section of a thesis chapter, a chapter, conference and journal papers and the thesis itself.

This staged approach to encouraging progress appears to be especially helpful in the case of part-time externally enrolled candidates. For example, a Middle mid-range supervisor working in the Humanities & Arts establishes a face-to-face relationship with part-time and externally enrolled candidates at the very beginning of the candidature. In the supervisor's view this practice cements the relationship between supervisor and candidate so that it can endure the privations and misunderstandings characteristic of supervision at a distance. The relationship begins with an informal contract between supervisor and candidate. This explicitly establishes the roles, responsibilities and expectations of supervisor and candidate. The candidate then works in external mode with agreed flexible deadlines and milestones in place. The initial milestone is a thesis outline in the form of chapter headings and sub-headings. Then, as the research topic is developed and investigated and the candidature progresses this outline forms the substance of future communication as chapters are progressively drafted. Face-to-face contact occurs on an as-needed basis, determined by the supervisor's and the candidate's combined judgment of progression or lack of it. In this supervisor's experience, face-to-face meetings once or twice a year suffice.

Another problem candidates routinely encounter is confusion when reading research literature and reviewing it. 'Hands on' supervisors reduce the disequilibrium associated with this problem in at least two ways. Typically, the 'hands on' supervisor directs the candidate to relevant research literature, a contrast with the tendency for 'hands off' supervisors to suggest candidates spend up to 12 months searching for and making sense of an unspecified corpus of research literature. A second strategy involves supervisors negotiating a diversified approach with candidates such that multiple tasks and aspects of the candidature are undertaken simultaneously (for example, literature review together with development of a theoretical framework or research method(s)). When one task stalls, as frequently happens, 'hands on' supervisors advise the candidate to set it aside and come back to, refine or change it while more fruitful avenues are pursued. This contrasts with a 'hands off' approach that presumes the candidate's ingenuity is the sole device for determining a strategy for progress.

Even sophisticated candidates pursue 'dead-end' lines of inquiry during their research. While 'hands on' supervisors recognise this behaviour as a perhaps harsh but necessary learning

experience, they limit its extent and duration via judicious intervention. As one High-range Natural Sciences supervisor put it, *'a month running up a blind alley usually constitutes enough learning'*.

In contrast with these strategies, while 'hands off' approaches assume that these sorts of problems will arise they are not viewed as the supervisor's responsibility. As one 'hands off' Low mid-range supervisor working in the Social Sciences suggested, when it is presumed that responsibility for these matters lies solely with the candidate, surprising things happen.

This supervisor's candidates are either career professionals or academics already employed in other universities. The supervisor has expectations of self-reliance of these external candidates who are widely dispersed around the country. A Senior Lecturer with 10 years' supervisory experience, this supervisor recently started to co-author with a few candidates, is networked with other academics elsewhere and has won research income sporadically but not for the purpose of funding PhD candidatures. Survey data indicate that over the period 1990–97 a total of 26 candidates (nine full-time and 17 part-time) were supervised, with a provisional completion rate of 24 per cent (four full-time and two part-time with some candidates yet to complete).

This supervisor now regrets assuming that candidates should initiate contact. In this supervisor's past practice, up to a year sometimes went by between electronic communications. The perils of such infrequent communication became evident when a candidate sent what the candidate believed to be a complete thesis draft. The supervisor found this draft indecipherable and had some difficulty convincing the candidate, who was an academic working in another university, to rework the thesis. The supervisor now tries to initiate email contact with external candidates on a monthly basis.

In addition to the problem situations already described, candidates tend to say and do things that warn 'hands on' supervisors that they are having difficulties.

Warning signals

The following are warning signals that most 'hands on' supervisors recognise:

- Candidates are physically absent for a period of one or two days up to a week, although absences of this length are more often viewed as problematic in the Natural Sciences where supervisors either notice such absences themselves or have them brought to their attention by one or more members of their research group or team.
- Candidates miss or cancel scheduled meetings consecutively. 'Hands on' supervisors interpret this as avoidance behaviour on the part of the candidate, indicating that the candidate believes him or herself not to be making progress. Especially in the early stages of candidature candidates' perceptions of their progress and the progress they have in fact made can differ.
- Candidates repeatedly fail to generate text, meet deadlines or achieve milestones.

In all of these situations, 'hands on' supervisors actively seek out their candidates rather than waiting for the candidate to approach them. They do this because problems indicated by these warning signals tend to be relatively minor when discussed and dealt with before they escalate. Where necessary, for example when they and their candidates cannot reconcile differences, 'hands on' supervisors seek mediation by others and on occasions institutional

assistance. In contrast, ‘hands off’ approaches assume it is the candidate’s responsibility to keep the candidature on track.

In situations where problems indicated by these and other warning signals are of a personal nature, ‘hands on’ supervisors do not take on a counselling role other than to assist the candidate to determine the likely effect of the personal problem on the candidature and appropriate courses of action (seeking counselling for example, or taking leave of absence).

In addition, the following ‘hands on’ practices assist the progress and completion of candidatures:

- Development of a flexible combination of formal and informal group and one-to-one meetings that enable as-needed candidate-initiated interaction, scheduled meetings and social interaction. Natural Sciences research laboratory teams make informal advice available on a daily basis and provide candidates with regular constructive criticism via scheduled research team meetings.
- Early and ongoing generation of text by the candidate, as the basis of routine discussion and written feedback as well as for the purpose of enabling evidence-based reflection on short- and longer-term progress.
- Rapid turnaround of edited script (ideally within 24–48 hours).
- Co-authorship of conference posters, papers and journal articles, coupled to personal and public acknowledgement and celebration of the candidate’s and the team’s success in achieving publication. This serves the dual function of constituting evidence of the candidate’s medium-term progress as well as their acceptance by an external professional community.

The frequency and extent of ‘hands on’ supervisors’ interventions tends to decrease as the candidature progresses. Decreased intervention is a consequence of both the supervisor’s expectation that their relationship with candidates becomes one of peer interaction and of the candidate’s self-recognition of becoming self-reliant. As self-reliance develops, candidates increasingly take the initiative in determining the frequency and extent of supervisory input required. The extent and frequency of ‘hands on’ supervision decreases as the candidature matures. The point at which this change in the relationship occurs varies. For some candidates the change begins within the first year of candidature while for others the transition occurs in the third or fourth year.

Although an increase in self-reliance is noticeable in the quality of candidates’ text generation, ‘hands on’ supervisors maintain frequent involvement in periods of intense candidate writing activity later in the candidature, especially as thesis submission looms. While ‘hands on’ supervisors may make less substantive comments on candidates’ text as the candidature progresses, overnight text turnaround remains common and one week turnaround is considered too slow for smaller text chunks such as thesis chapters or journal papers, unless a longer period is negotiated beforehand.

The rapid turnaround by ‘hands on’ supervisors overwhelmingly involves reading a candidate’s text in the supervisors’ own time, on week-nights or over the weekend. This phenomenon signals an academic work-load issue that is raised in the concluding chapter.

Summary

‘Hands on’ supervisory pedagogy suggests an interventionist design for PhD supervision. This design emphasises the importance of assisting commencing candidates to demystify and structure their candidature. It involves frequent, timely and collaborative intervention by the supervisor and others in the first year of candidature. It entails strategies for assisting candidates to overcome comparatively common problems such as lack of confidence and confusion. It is supported by a trust relationship between supervisor and candidate that enables supervisors, candidates and relevant others to monitor and celebrate the progress of the candidature. While interventions decrease in frequency and depth as the candidate becomes more self-reliant, the emphasis on text generation by the candidate and rapid turnaround of text by the supervisor are core ingredients of the pedagogy. The report now turns to consideration of these and other matters identified in preceding chapters.

Matters for consideration

In September 2001 DEST (then DETYA) released an Occasional Paper reporting postgraduate completions for research doctoral and masters students (Martin et al, 2001). Two findings were that an estimated 65 per cent of doctoral candidates eventually complete their degrees and that 36.1 per cent of doctoral candidates complete their degrees within four years full-time equivalent study.

The approximate completion rate of 64 per cent reported in the present study is similar to the 65 per cent estimated by DEST. The approximate 40 per cent of submissions within four years reported in this study compares with DEST's 36.1 per cent. The two sets of figures were arrived at using different data sets, which suggests a degree of diachronic reliability in the statistics. Comparing the two suggests that overall completions may be rising and that aggregate submissions of doctoral dissertations in four years or less are increasing.

DEST's data referred to the 1992 cohort of PhD students, while the present study covers the 1990–97 period. It is possible that during the build-up to the White Paper in 1999 and following the roll-out of the Research Training Scheme (RTS) in 2000, the progress of a portion of the 1990–97 cohort of PhD candidates accelerated relative to the 1992 cohort. In addition, if one assumes that the figures reported in the present study are more likely than not to be under-estimates than over-estimates and given the long tail on completions, an eventual completion rate closer to 70 per cent is plausible.

Matters of federal policy

If these conjectures are right, then it could be inferred that the RTS is moving in the direction of achieving its goal of improving completions and times for submission of PhDs on a national scale. Whether this tendency is uniform across disciplines is less discernable, because no comparable discipline-specific completions and submissions data exist.

However, RTS funding rewards publications output, research grant winnings and RHD completions and this study shows that:

1. the greatest publications output occurs in the Natural Sciences
2. the Natural Sciences is competitively oriented and successful in winning research grants
3. these factors contribute to the better aggregate performance of PhD candidates in the Natural Sciences.

In addition, the involvement of the private sector in PhD candidatures appears to have a beneficial effect on timely completions. Private sector support of PhDs is strong in the Natural Sciences but weak in the Social Sciences and the Humanities & Arts. Further, the beneficence of the Australian Research Council in relation to the funding of PhD scholarships is most evident in the Natural Sciences.

This scenario suggest that injections of both state and private research support are likely to benefit the Natural Sciences more than the Social Sciences and the Humanities & Arts. At the level of federal policy it could therefore be argued on the one hand that the Social Sciences and the Humanities & Arts require some shelter from the competitive forces that currently appear to disadvantage them at an aggregate level. The beneficial effects of scholarships might be considered here.

On the other hand, it could be argued that the current situation be maintained with relatively less:

- candidates undertaking PhDs in the Social Sciences and the Humanities & Arts overall, and/or
- part-time candidates undertaking PhDs in the Social Sciences and the Humanities & Arts, and/or
- external candidates undertaking PhDs in the Social Sciences and the Humanities & Arts.

Matters of university policy

The last three points made above are equally important at the level of university policy, because they indicate that there is scope for universities to adjust the mix of non-and scholarship candidates they wish to fund, enrolment modes they wish to employ and fees they wish to charge or not.

There are also similarities between research undertaken under the auspices of the PhD, and, alternative activities defined as 'consultancy'. Additional similarities exist between PhDs and degrees otherwise offered as 'professional doctorates'. These similarities show that there is already flexibility in what universities offer as a PhD. Combined with the matters of non- and scholarship places and enrolment modes, this flexibility implies potential for universities to further diversify their research higher degree offerings.

Related to these matters is the academic career structure. There is marked variation between the research and supervision performance of individual academics that is associated with the length and status of their academic career. Additionally, the PhD is not a teaching qualification. Moreover, irrespective of university type and discipline, it appears that the gestation period of the conventional academic career and its traditional progression are protracted. In particular, including post-doctoral appointments a pre-requisite to supervision in the Natural Sciences consists of between 21 and 25 years of continuous and progressively higher formal education. Although supervision in the Social Sciences and the Humanities & Arts requires a less continuous and specialised path, it is more likely to be interrupted and may well take longer than the Natural Scientific trajectory.

These circumstances suggest that, relative to alternative employment opportunities and remuneration, better returns to the candidate can be achieved by opting for vocational choices other than the PhD. This scenario is worthy of investigation in its own right, given that systematic research evidence about PhD graduates is non-existent. It is also worthy of universities' attention, because it indicates that the present preference for academics to possess PhDs may be over-valued. The PhD, research and research training may be enhanced by universities differentiating between teaching and research and the development of rewarding career structures for both.

This option would affect academic workloads. The data show that 'hands on' supervisors in particular allocate much of what could be termed their own time to text turnaround. Undoubtedly there is more than dedication to duty associated with this practice, especially in the Natural Sciences where the candidate's research is an integral part of broader research agenda. Differentiated career structures might lighten academic workloads, but there are seemingly inherent cultural factors that could hinder this strategy.

Matters of research culture

University type exerts influence over PhD completions and times to submission, but the influence that research cultures exert is greater. More specifically, while at an aggregate level Go8 universities outperform non-Go8 universities it is likely that within universities more influential disciplinary differences are at work. These influences are evinced by associations between timely completions and discipline-specific:

- variations in the scope and range of PhDs
- preferences for particular forms of PhDs
- publications customs, especially co-authorship between PhD supervisors and candidates
- modus operandi for the conduct of research and PhD supervision.

Alternatively, disciplinary similarities on these counts are associated with more and timely completions and are evinced by supervisors in the Social Sciences and the Humanities & Arts who:

- involve their candidates in established research agendas
- emphasise research training and the substance of the PhD
- informally organise their candidates into cohorts
- supplement their supervision with informal coursework
- are linked to industry
- employ a 'hands on' supervisory pedagogy.

Whether the Social Sciences and the Humanities & Arts *ought* to adopt this largely Natural Sciences research and supervision model is a different matter to whether they can do so. That successful Social Sciences and Humanities & Arts supervisors already appear to have applied it some extent is evidence that such is both possible and beneficial. It suggests in particular that it does not follow from Social Sciences and Humanities & Arts research method that the research process and PhD supervision must and can only be carried out by individuals working in isolation. Indeed the transdisciplinarity evinced by the data of supervisors who identified themselves as working in 'Other' disciplines, combined with the tendency toward success in the case of supervisors involved with PhDs characterised by industry considerations and supported by stakeholders additional to universities, reflects a phenomenon discussed by Novotny et al. (2001, pp 11–15). They describe the growing development of knowledge production and dissemination outside of the historically university-based monopoly over research ('Mode 1 knowledge'). More socially contextualised in practice and application, this trans-disciplinary ('Mode 2 knowledge') development reflects processes of social change that characterise the present historical period and are additionally evident in Natural Sciences PhDs that are 'consultancy-like'.

Overarching considerations

These considerations bear on the purpose and future of the PhD. If it is the case that the knowledge economy is characterised by and demands rapid knowledge production, then the utility of a PhD exercise that generates around 40 per cent aggregate completion in four years and at best 48 per cent completion in four years in the Natural Sciences is questionable as a national vehicle for training future researchers who will likely operate in an increasingly fast-

paced research and knowledge production environment. The elongated academic career structure appears to be less rewarding and inspirational for the generation of knowledge and innovation than it once was. It may well be less appealing to future generations of researchers that the PhD exercise uncritically presumes will replace the current generation of academics. In short, the PhD exercise and its associated dilemmas is a symptom of a larger issue of the changing relationship of academics and universities to the rest of the world.

Appendix 1: Methods

This study involved two methods of data collection. A two-part electronic survey was used to develop a profile of PhD supervision and a database of current PhD supervisors. From that database a selection of supervisors was identified and interviewed on the apparent strength or weakness of their association with the completion of PhD candidatures over time.

Survey design

The electronic survey was designed to capture institutional and individual data on a range of measures (see below for full survey questionnaires). It aimed to collect data about individual supervisors and their academic and supervisory careers, and to identify potential interviewees on the basis of their apparent association with timely completion of PhD candidatures.

The survey data were cleaned and coded and entered into a SPSS (SPSS is the name of both the programme and the company which produces it) data file. The data were analysed using SPSS. The analysis was conducted using only those respondents who indicated that they had supervised students during the 1990–97 period. This equated to a sample size of 1048 for the first survey and 567 for the second survey. Survey data are presented and analysed in Appendix 2.

Initial survey

A trial survey was conducted with a sample of 30 academics working in Australian universities (all trial participants were excluded from the survey proper). The survey proper then contacted 5450 PhD supervisors working in 28 Universities in state and private universities across all states and territories of Australia.

Email contacts for individual supervisors were collected with the assistance of the Deans and Directors of Graduate Studies (DDOGS) Committee, whose institutions were asked to supply email contacts for all current supervisors of PhD candidates. 16 full lists of contacts for PhD supervisors were furnished. 12 partial lists of contacts were assembled. The survey included four Go8 universities and 24 non-Go8 universities, of which two and 14 respectively provided full lists of contacts.

The initial survey involved an electronic mail-out that invited PhD supervisors to participate in the study by accessing a dedicated web site and then filling out an electronic survey instrument located on that site. The initial survey consisted of four bulk mail outs using the Infacta email programme GroupMail Pro-v3.3.010.

Mail out 1 was completed on 16August 2001. The sample consisted of 6437 unique email addresses. 6433 were of these were successfully sent with a recorded four errors, but a number of emails bounced because of email system or address-route problems. These emails were separated into different folders as follows:

- Unrouteable: 505
- Mail System: returned mail: 437
- Not sent for four hours: 32
- Message Status: 9
- Total emails not delivered: 983

As of August 22, there were 590 completed surveys and 409 incompletes. The reason for the high number of incompletes is varied, ranging from participants realising that they were not part of the target group through to computer programme and technical incompatibilities.

Mail out 2 was completed on 23August 2001. A number of email addresses (787) were excluded, because they were either completes or because the participants had responded (either automatically or manually) and indicated they did not wish to participate or were unavailable during the study period. 5650 emails were sent. A total of 928 were unable to be delivered. This included 915 that were rejected on the first mail out. As of 30 August 2001(the day of Mail out 3) there were 1103 completed surveys.

Mail out 3 was completed on 30 August 2001. A number of email addresses (1882) were excluded, for reasons the same as those stated above; 4545 emails were sent. As of 11 September 2001 there was 1417 completed surveys and 711 incomplete, a total of 2128 responses.

Mail out 4 occurred on 14 September 2001. It focused solely on incomplete surveys and 653 emails were sent.

At the completion of Mail out 4 there was a total of 1499 completed surveys and 711 incomplete, giving a total response rate of over 40 per cent comprised of 2210 responses from a sample of 5450 (the original sample subtracting the bounced emails). Of the 1499 completed responses, supervisors who reported that they supervised PhD students between 1990–97 returned 1048. This group formed the total sample for the second survey, because it contained an historical record of association with PhD completions over time.

While the 40 per cent response to the first survey may seem low, the mail outs elicited quite a large number of email and telephone responses expressing opposition to the conduct of the research. These responses ranged from brief expressions of disbelief of all things statistical or associated with DEST (DETYA at the time), to quite personal comments about the researcher's ethics. As one respondent put it, the researcher *'should be ashamed of [him]self for getting into bed with the organisation that is single-handedly responsible for the destruction of higher education in this country'*. Messages such as these suggest that the apparently low response rate to the survey may well be an indication of broader dissatisfaction among academics with federal government higher education policy at the time.

There was also some confusion registered by survey participants who entered incomplete responses. This related to the survey's function of skipping the second page of questions in the case of respondents who reported at Question 4a that they did not supervise candidates over the 1990–97 period.

The initial survey appears below, as it was presented on the dedicated web site. Responses to questions and their analysis are contained in Appendix 2.

This survey is being conducted through the ***Faculty of Education and Creative Arts*** *and the* ***Population Research Laboratory at Central Queensland University*** *on behalf of* ***DETYA***

This survey takes only a few minutes - if you are not presently or have never supervised any PhD students please do not complete this survey

Q1a. Your **gender?**

- Female
- Male

Q1b. What is your **academic designation** ? Please specify

Q1c. The majority of my supervisory duties are undertaken as a member of:
A designated CRC

Q1d. Please insert the name of this CRC/Centre/School/Faculty in the space below

The following questions refer to full- and part-time **Ph.D. students** and **supervision** in any capacity (e.g., principal supervisor, Co-supervisor, Adjunct supervisor, or any other supervising title)

Q2. I began supervising PhD students in (insert year)

Q3. I provide supervision predominantly in The Natural Sciences

Q4. How many PhD students are you **currently** supervising? Please select number

Q4a. How **many** PhD students did you supervise over the period 1990-1997?
Please select number

5 How many of these students did you supervise in the capacity of **Principal Supervisor** in a

team of 3 or less supervisors?

Please select number

6. How many of these students did you supervise in the capacity of **Co-Supervisor/Associate Supervisor in a team of 3 or less Supervisors** ?

Please select number

7. How many of these students did you supervise in any capacity in any model involving **more than 3 Supervisors** ?

Please select number

8. To the present day, how many of the students you supervised over the period 1990-1997 have been **conferred** with the award of Doctor of Philosophy (PhD)?

Please select number

9. Of those students who have been conferred, **how many submitted their doctoral dissertations for examination in equivalent Full-Time years:** *(e.g. if a student submitted 3 years and 1 day into their candidature, include that student in the category '3 to 4 years')*

a. **3** years or **less** ? Please select number

b. **3 to 4** years? Please select number

c. **4 to 5** years? Please select number

d. **5 to 6** years? Please select number

e. **6 to 7** years? Please select number

f. **7** years or **more** ? Please select number

Please answer the following questions about your ***academic record***

Q10. How many single-authored books have you published?

Q11. How many Co-authored books have you published? ☐

Q12. How many published books have you Co-authored with your present or former PhD students? ☐

Q13. How may sole edited collections have you published internationally? ☐

Q14. How many Co-edited collections have you published internationally? ☐

Q15. How many collections have you Co-edited with your PhD students? ☐

Q16. How many internationally refereed, sole authored journal papers have you published? ☐

Q17. How many Co-authored, internationally refereed journal papers have you published? ☐

Q18. How many internationally refereed journal papers have you published as a Co-author with your present or former PhD students? ☐

. Q19. How many refereed papers have you solo-presented at International Conferences? ☐

Q20. How many refereed papers have you Co-presented at International Conferences? ☐

Q21. How many refereed papers have you Co-presented at International Conferences, with your present of former PhD students? ☐

Q22. How many ARC Large Grants (all categories combined) have you won (individual and team combined)? ☐

Q23. How many ARC Small Grants have you won (individual and team combined)? ☐

Q24. How many competitive research/consultancy tenders have you won (individual and team combined)? ☐

Thank you for completing this survey.

This survey is being conducted by the Faculty of Education and Creative Arts and The Population Research Laboratory at Central Queensland University on behalf of DETYA

Second survey

Of the 1048 supervisors who supervised students between 1990–97, 1032 were contactable by email in October 2001 and were invited to participate in a second survey. The first Mail out of the second survey was completed on 4 October 2001. Response to this mail out included 308 complete surveys and 107 incomplete surveys.

The second Mail out was completed on 11 October 2001. A total of 696 emails were sent. This represented the remaining sample minus individuals who had completed the initial mail out and participants who were on leave or had requested removal from the study. There were 324 exclusions listed on the mail programme.

The third Mail out was completed on 18 October 2001. At time of mailing there were 490 completes and 188 incomplete surveys. A total of 556 emails were sent; 475 addresses were excluded. Some participants were removed by other means to ensure their right not to participate, which explains a discrepancy in the numbers. Data collection closed on 25 October 2001.

In sum there were 567 completed surveys and 203 incomplete, a total of 770 responses from a total sample of 1032 giving a response rate of 75 per cent including 55 per cent completed responses.

Potential interview participants were identified from the completed sub-set of the sample, on the basis of their apparent association with full- and part-time PhD completions or apparent lack of such.

The second survey appears below, as it was presented on the dedicated web site. Responses to questions and their analysis are contained in Appendix 2.

This survey is being conducted through the ***Faculty of Education and Creative Arts*** *and the* ***Population Research Laboratory at Central Queensland University*** *on behalf of* ***DETYA***

This survey takes only a few minutes - if you are not presently or have never supervised any PhD students please do not complete this survey

Q1. How many of the PhD students that you supervised over the period 1990-1997 held candidatures that were predominantly

Full-Time? Please select number **Part-Time** ? Please select number

Q2. **Of those who were conferred**, how many held candidatures that were predominantly

Full-Time? Please select number **Part-Time?** Please select number

Q3a. How many of these conferred students **did not change supervisors** during their candidature? Please select number

Q3b. **Of these students**, how many held candidatures that were predominantly:

Full-Time? Please select number **Part-Time?** Please select number

Q4a. How many of the conferred students **did not change their thesis topic substantively after their first year of candidature**? Please select number

Q4b. **Of these students**, how many held candidatures that were predominantly?

Full-Time? Please select number **Part-Time?** Please select number

Q5a. How many of the conferred students **completed their candidature without deferral**?

Q5b. **Of these students**, how many held candidatures that were predominantly?

Full-Time? Please select number **Part-Time?** Please select number

Q6a. How many of the PhD students that you supervised between 1990-1997 were **in receipt of a Scholarship** (e.g. APAWS)? Please select number

Q6b. How many of these students were conferred? Please select number

Q6c. **When these students completed their candidature**, how many were enrolled

Full-Time? Please select number **Part-Time?** Please select number

Q7. Does your organisational unit (Centre/School/Faculty/Department) follow a specified policy or set of protocols for

selecting PhD candidates? Y/N **supervising PhD candidates**? Y/N

Q9. Does your organisational unit (Centre/School/Faculty/Department) follow a specified policy or set of protocols for

selecting PhD supervisors? Y/N **training PhD supervisors**? Y/N

Q11. Does your **PhD supervisory practice** (either as an individual or as part of an organisational unit) include formalised research training of students? Y/N

Q12. How often do you meet **face-to-face** with PhD students who are

Full-Time? Please select number **Part-Time?** Please select number

Q13. How often do you meet **electronically (including phone/conventional mail/fax/email/teleconference)** with PhD students who are

Full-Time? Please select number **Part-Time?** Please select number

Q14. How many PhD theses have you **examined?** Please select number

Q15. Q9. Does your organisational unit (Centre/School/Faculty/Department) follow a specified policy or set of protocols for

selecting internal PhD examiners? Y/N **examining PhD theses internally**? Y/N

selecting external PhD examiners? Y/N **examining PhD theses externally**? Y/N

Q1i. Of the **Full-Time** students that you supervised between 1990-1997 and who have been conferred with the award of Doctor of Philosophy, how many completed their candidature without taking a leave of absence ?

Q1j. Of the **Part-Time** students you supervised between 1990-1997 and who have been conferred with the award of Doctor of Philosophy, how many completed their candidature without taking a leave of absence ?

Interviews

Potential interview candidates were selected solely on the basis of their apparent association with PhD non-completions and completions. This involved comparing data from their second survey referring to:

- the numbers of full- and part-time students supervised during the 1990–97 period
- the corresponding numbers of these students who reportedly completed their degrees.

These comparisons yielded sets reflecting a range of high and low numbers of provisional completions and nominal percentages relative to students supervised.

Supervisor ranges

High-range referred to total numbers of completions of 16 or more, with an apparent completion rate of 82 per cent or more. In terms of full- and full-time candidates, examples of High-range included:

- 7 and 14 full- and part-time candidates (21 in all) with 100 per cent completion
- 22 and three full- and part-time candidates (25 in all) with 100 per cent completion

Low Range initially referred to total numbers of students supervised of eight or more, but with an apparent completion rate below 20 per cent.

No supervisors with fewer than 20 per cent apparent completions of predominantly full-time candidates were found.

All supervisors in the Low Range were contacted but either did not respond to email contact, declined to be interviewed or were unavailable for interview. An adjustment was therefore made whereby a minimum number of completions of six completions and supervisions greater than 15 was used to develop a Low mid-range. A Mid-range with High, Middle and Low sections resulted. The figures were selected because the bulk of the supervisors' data showed completions *and* numbers of candidates supervised at six or fewer and it was presumed that these supervisors would not be able to furnish interview data as rich as the High and Mid Ranges of the sample.

The High mid-range involved completion rates of 100 per cent involving between 10 and 14 completions, for example:

- 11 and three full- and part-time candidates (14 in all) with 100 per cent completion
- 5 and five full- and part-time candidates (10 in all) with 100 per cent completion.

It also included apparent completion rates of between 77 per cent and 93 per cent involving 11 or more completions, for example:

- 22 and four full- and part-time candidates (26 in all) with 17 and three respective completions (20 in all) or 77 per cent apparent completion
- 13 and two full- and part-time candidates (15 in all) with 12 and two respective completions (14 in all) or 93 per cent apparent completion.

The Middle mid-range involved apparent completion rates of between 75 and 100 per cent with between seven and 10 completions, for example:

- 8 and four full- and part-time candidates (12 in all) with seven and two respective completions (nine in all) or 75 per cent apparent completion
- 6 and two full- and part-time completions (eight in all) with six and two respective completions (eight in all) or 100 per cent completion.

The Low mid-range involved apparent completion rates of between 24 and 67 per cent, for example:

- 7 and 12 full- and part-time candidates (19 in all) with three and three respective completions (six in all) or 32 per cent apparent completion
- 10 and 16 full- and part-time completions (26 in all) with six and six respective completions (12 in all) or 47 per cent apparent completion.

Supervisors whose total supervisions involved half or more part-time candidates, had apparent completions of 50 per cent or below, for example:

- 9 and 10 full- and part-time candidates (19 in all) with one and four respective completions (five in all) or 26 per cent apparent completion
- 3 and 22 full- and part-time candidates (25 in all) with two and four respective completions (six in all) or 24 per cent apparent completion.

Email contact was made with 149 respondents to the second survey and they were invited to contribute an interview to the study on the basis of their survey returns. This included the initial Low Range. 86 consented to an interview via return email. These participants were located in 17 universities, four G8 and 13 non-G8 universities. The interview schedule covered 10 days in November 2001, 21 days in March 2002 and 27 days over April–May 2002. Three interviews fell through.

Eighty-three interviews of between one and two and one quarter hours duration were undertaken with:

- 11 supervisors from the High-range
- 26 supervisors from the High mid-range
- 26 supervisors from the Middle mid-range
- 20 supervisors from the Low mid-range.

In addition, either via email, telephone or face-to-face contact prior to or when the researcher was on location, supervisors were asked to provide contacts for any of their present or former PhD candidates who might wish to contribute an interview to the study. Supervisor interviewees and candidate interviewees were informed of the reason motivating these interviews, namely the collection of data that could be correlated with supervisor interviews.

Forty-seven present or former PhD candidates were contacted either by email or telephone and asked to contribute an interview. Some were contacted before supervisors had been interviewed, others after. Four candidates who were not supervised by supervisors that participated in the study were contacted by other supervisors who did participate in it. Two

candidates became aware of the study via the means some universities used to apprise supervisors of it. These candidates made direct contact with the researcher and expressed an interest in contributing an interview. In total, 26 present and former PhD candidates agreed to and gave interviews of lengths varying from one to two hours.

All of the interviews were conducted and audio-taped with the interviewees' verbal consent. All interviewees were informed that the interviews were strictly confidential. They consented to be interviewed on the condition that none of their data would be reported in such a way that they or any other individual or their organisational element or their university could be identified.

In order to generate comparable data sets, all supervisors were asked the same questions (see structured interview schedule below). In addition, in order to corroborate supervisors' interview data present or former candidates were asked the same questions adapted to their candidate status.

At interview, questions were not necessarily asked in the order they appear below. The researcher chose at times to probe interviewees about the details of their responses to particular questions and on occasions this led to questions being asked in a different order.

Structured interview schedule

INTERVIEWEE:

AGE:

LOCATION:

NAT SCI	SOC SCI	A & H	Other
CRC	UNI RES CENTRE	FACULTY	SCHOOL

DEPARTMENT

How did you come to work in a University?

How did you come to supervise PhD candidates?

What is a PhD?

What is supervision?

Does your Centre/School/Faculty follow a policy or set of protocols for selecting PhD candidates?

Can you describe it?

Does your Centre/School/Faculty follow a policy or set of protocols for selecting PhD supervisors?

Can you describe it?

Does your Centre/School/Faculty follow a policy or set of protocols for supervising PhD candidates?

Can you describe it?

Does your Centre/School/Faculty follow a policy or set of protocols for training PhD supervisors?

Can you describe it?

What qualities do you look for in a potential PhD candidate?

How do you go about supervising students?

Do you follow any sort of formula for supervising students?

Can you describe it?

What prior knowledge do you presume on the part of students?'

Are there particular methods of supervision that you use at particular times for particular purposes?

Can you describe these methods and when and why you use them?'

To what extent do you/does the student take charge of the candidature?

Does the extent to which you/the student takes charge of the candidature vary over time?

Can you give some examples of when and why these variations occur?'

Are there particular warning signals that candidates give which tell you they might be in trouble?

Can you give me some examples?

How do you know that a candidate is progressing satisfactorily and does not need your intervention?

How do you resolve tensions between yourself and students?

How important is the first year of candidature?

Why?

Are there any matters that I haven't covered that you think are important?

All interview tapes were transcribed in full. Data were coded manually, according to:

- interviewees' completion range, discipline and university type
- interview questions.

All interviewees were assigned a coded number, in order to protect their confidentiality. The analysis then involved cross-referencing coded data in order to identify recurring themes as well as anomalies. The initial number of analytic categories was 47 and as the analysis progressed six themes and associated anomalies emerged. These themes and anomalies corresponded to the five relative advantages Natural Sciences research culture offers candidates in comparison with the Social Sciences and the Humanities & Arts (discussed in detail in the report's second chapter), and to the pedagogical dimension of PhD supervision (discussed in detail in Chapter 3).

Interview data are presented and analysed in two ways. The salient features of themes arising from the analysis are presented in the body of the report. In addition, an overview of the interview data analysis as well as extracts of data supporting discussion in the report's body is contained in Appendix 3.

In order to protect the confidentiality of interviewees, data that might conceivably identify interviewees have been deleted from the discussion. Where data extracts have been presented, the following reporting schema has been used:

R: = Researcher
(Range)(Discipline)(number) e.g. HRNS3: = Interviewee
--- = Pause
… = deletion of words from interview transcript
[word] = deletion of word or words that might identify the interviewee and insertion of non-identifying words.

Appendix 2: Survey data

Initial survey

In this section of the appendix the data presented refer only to those supervisors who reported themselves as supervising candidates in the period 1990–97. Data are presented primarily as percentage data to allow comparisons across University type and Disciplines. Data were analysed using SPSS.

Respondents were:

- primarily from non-Go8 universities with 668 or 63.7 per cent of respondents being identified as working in these universities.
- predominantly from the Natural Sciences Discipline with 42.6 per cent of respondents coming from this discipline (see Table A1).

Table A1: Respondents by discipline

Discipline	Number	%
Natural Sciences	446	42.6
Social Sciences	287	27.4
Humanities & Arts	158	15.1
Other	157	15.0
Total	**1048**	**100.0**

Almost half of the sample that supervised PhD candidates in the—1990–97 period (49.7%) commenced supervising PhD candidates prior to 1992. When university type and discipline are taken into account this figure changes with 53.5 per cent of Go8 respondents commencing supervision prior to 1992 and 57.2 per cent of supervisors in the Natural Sciences commencing prior to 1992. Figures A1 and A2 show these differences.

Figure A1: Length of supervision career by university type

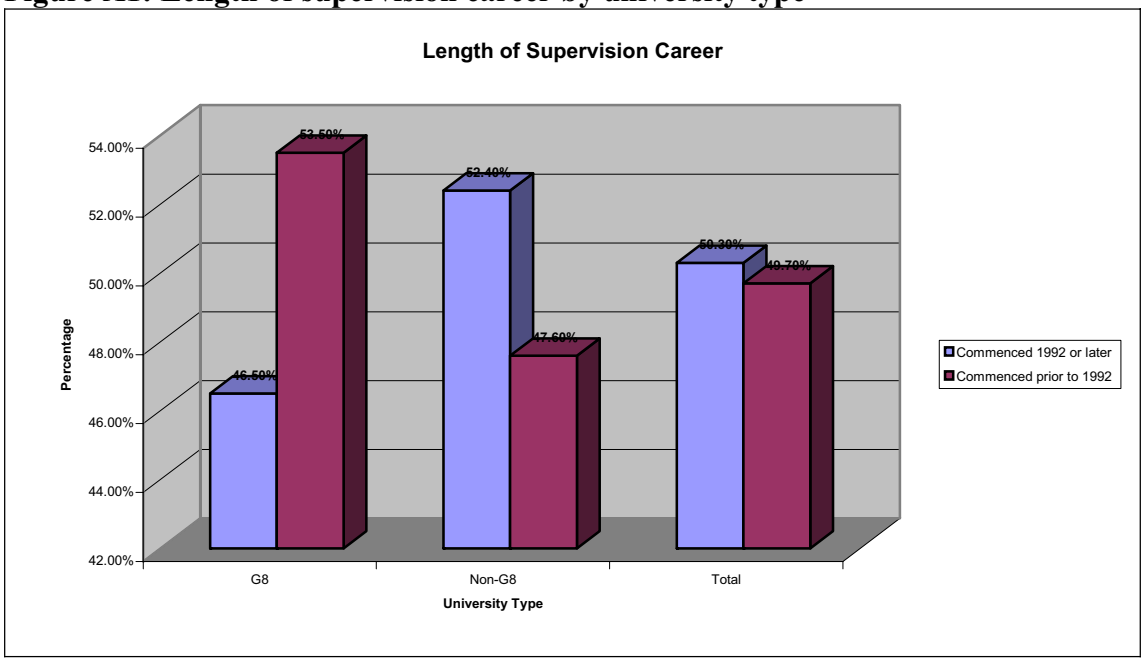
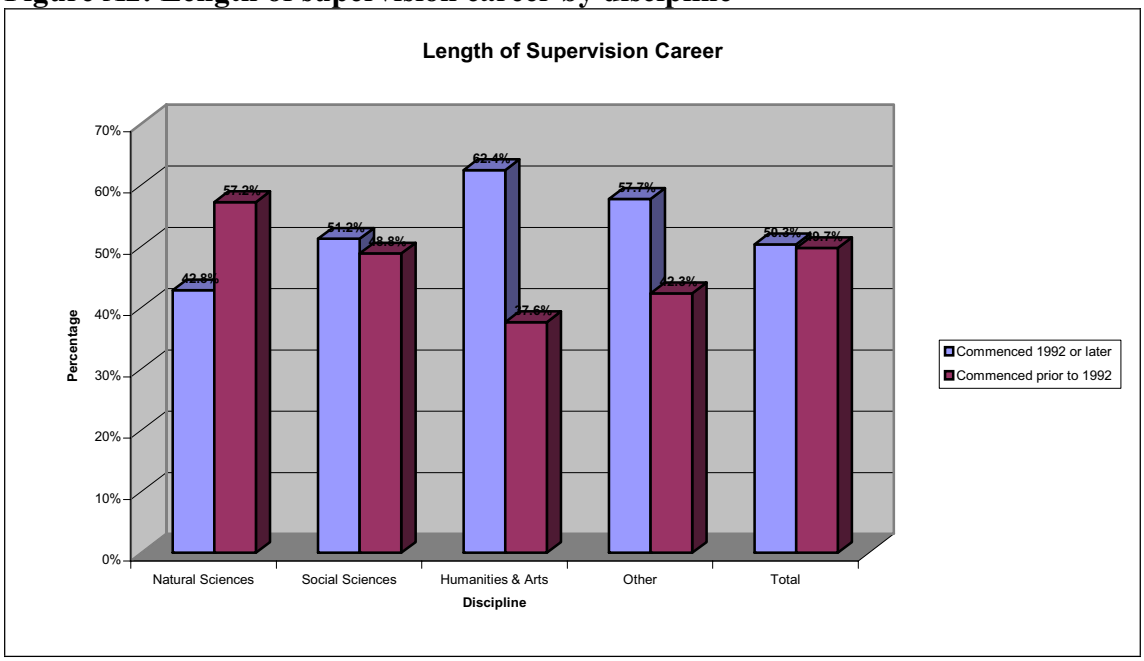


Figure A2: Length of supervision career by discipline



Completions

Overall, 63.94 per cent of candidates supervised in the 1990–97 period were conferred with the award of Doctor of Philosophy. Candidates from Go8 universities were more likely to have received the award (69.08%) than non-Go8 candidates (60.68%) (see Figure A3). Candidates from the Natural Sciences were more likely to have received the award (74.57%) than candidates from the Social Sciences (52.24%), the Humanities & Arts (54.17%) and Other Disciplines (61.24%) (see Figure A4).

Figure A3: Completion rates by university type

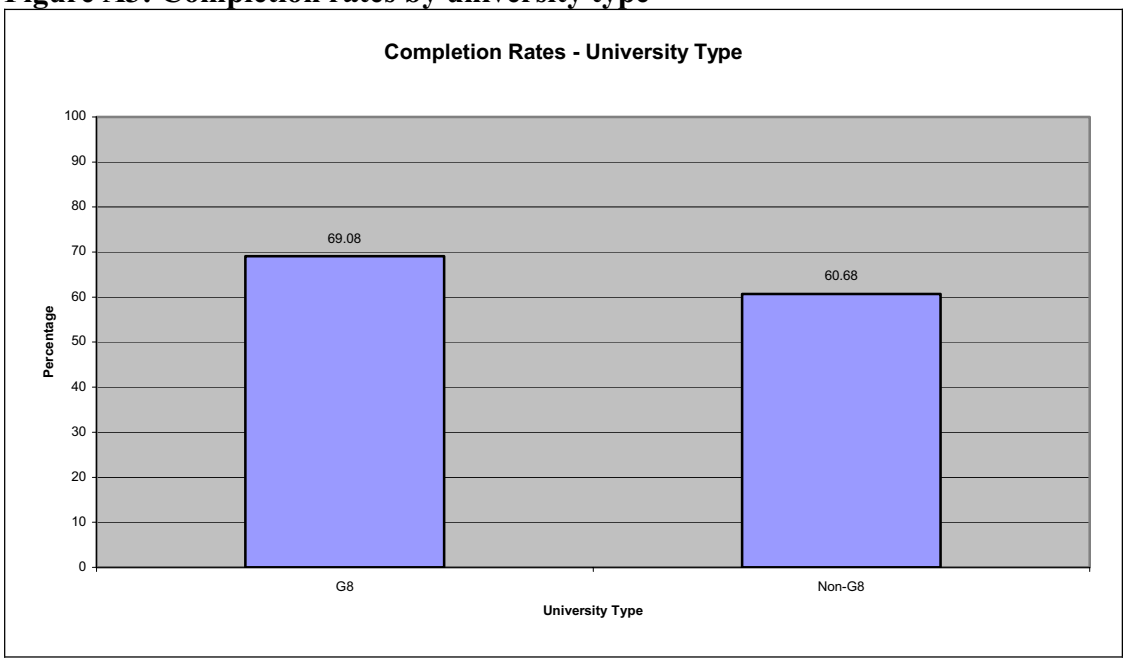
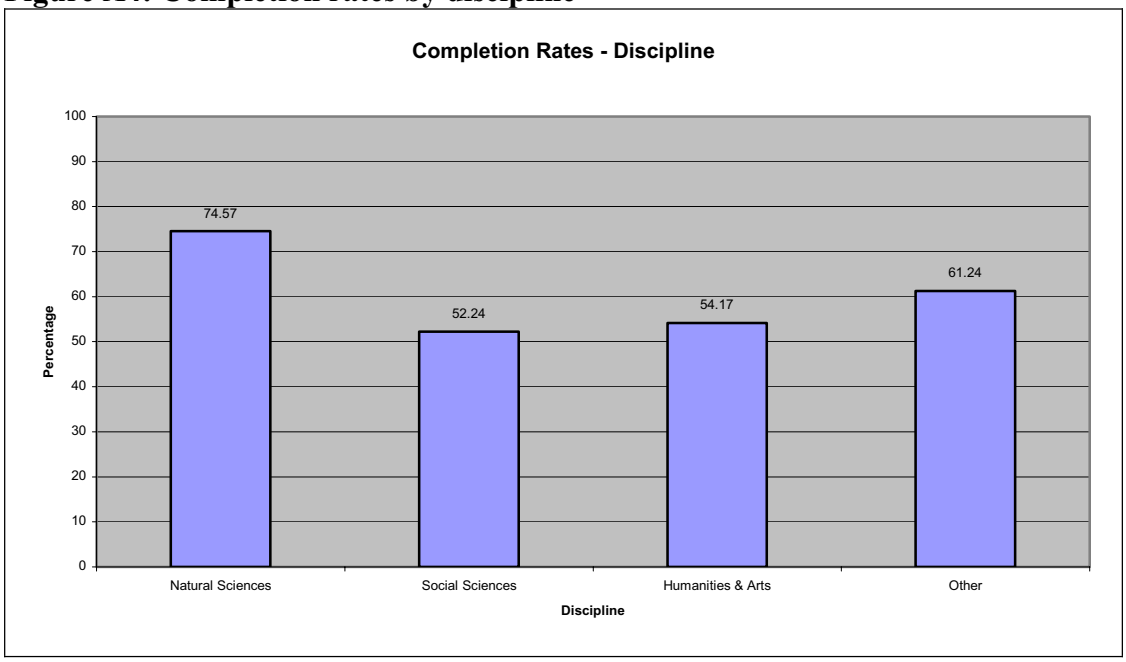


Figure A4: Completion rates by discipline



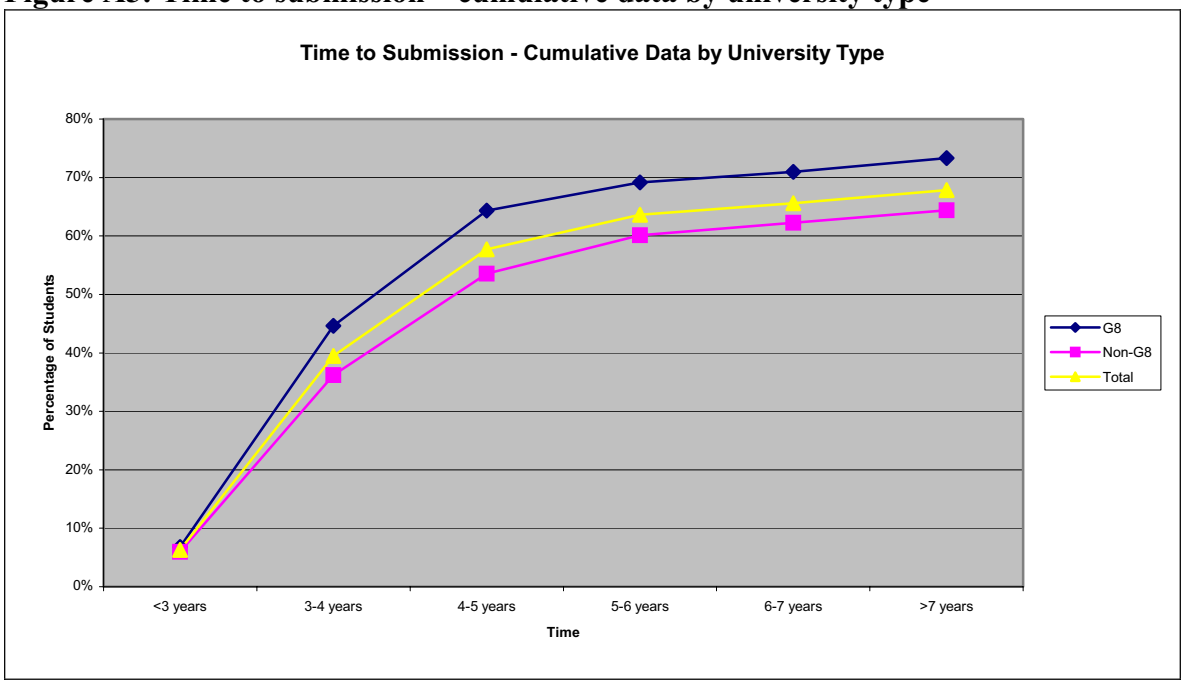
Submissions

Overall, 67.83 per cent of candidates submitted their dissertations for examination (see Table A2). More than 57 per cent of candidates submitted in five years or less. Slightly fewer than 40 per cent submitted in four years or less. Go8 candidates submitted in shorter times than non-Go8 candidates (see Figure A5).

Table A2: Time to submission—cumulative data by university type

Time to submission	Go8 %	Non-Go8 %	Total %
<3 years	6.82	5.97	6.30
3–4 years	44.65	36.21	39.47
4–5 years	64.32	53.58	57.73
5–6 years	69.17	60.10	63.61
6–7 years	70.95	62.23	65.61
>7 years	73.33	64.37	67.83

Figure A5: Time to submission—cumulative data by university type

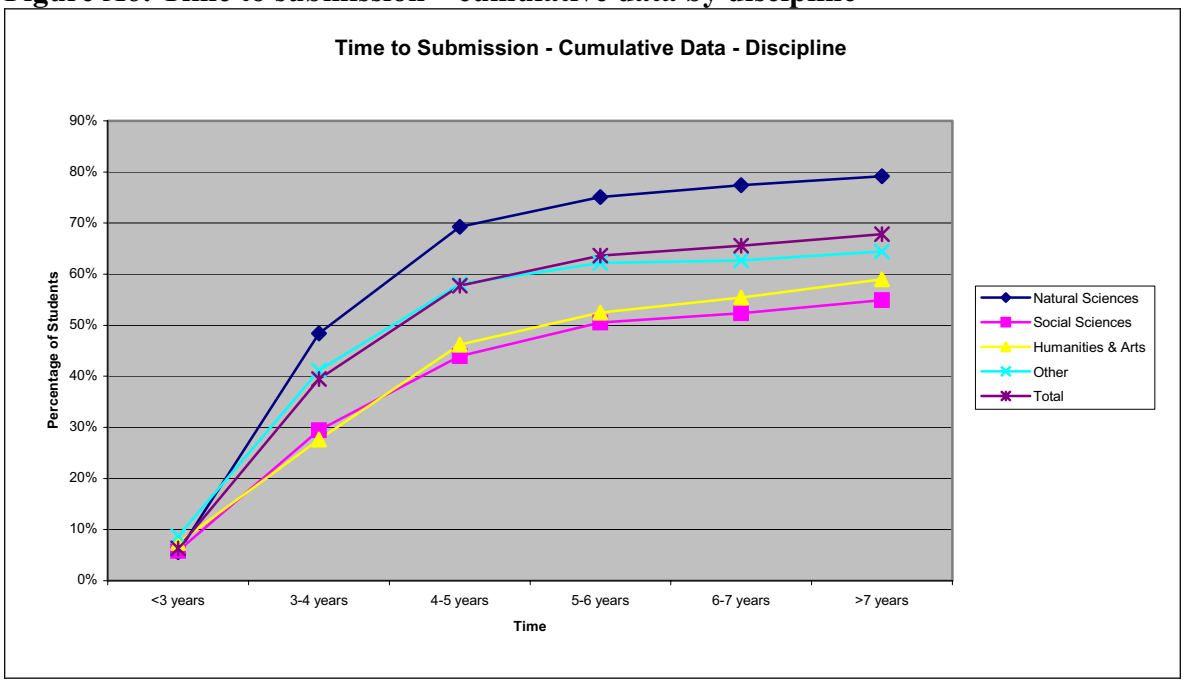


Candidates in the Natural Sciences submitted in shorter time frames than their counterparts in other disciplines (4 years or less: Natural Sciences 48.40%, Social Sciences 29.46%, Humanities & Arts 27.64%, Other Disciplines 41.14%) (see Table A3 and Figure A6).

Table A3: Time to submission—cumulative data by discipline

Time to submission	Natural Sciences %	Social Sciences %	Humanities & Arts %	Other %	Total %
<3 years	5.60	5.80	7.36	8.73	6.30
3–4 years	48.40	29.46	27.64	41.14	39.47
4–5 years	69.24	43.97	46.25	58.07	57.73
5–6 years	75.11	50.54	52.50	62.17	63.61
6–7 years	77.38	52.37	55.42	62.70	65.61
>7 years	79.16	54.95	59.03	64.42	67.83

Figure A6: Time to submission—cumulative data by discipline



Academic designation

Approximately 85 per cent of respondents had the academic designation of Senior Lecturer or above. Another 6 per cent had the 'Other'' designation. There are small differences across University type in regard to Academic Designation with non-Go8 universities having more Senior Lecturers and 'Other' designations than Go8 universities (see Figure A7). These differences were statistically significant (at α=0.01). There were greater differences across discipline (see Figure A8) and these differences were also statistically significant (at α=0.01). A greater percentage of Humanities & Arts supervisors (43.67%) held the designation Senior Lecturer. Those who considered they were working in Other disciplines were more likely to be designated Associate Professor (29.94%) or Professor (28.66%).

Figure A7: Academic designation by university type

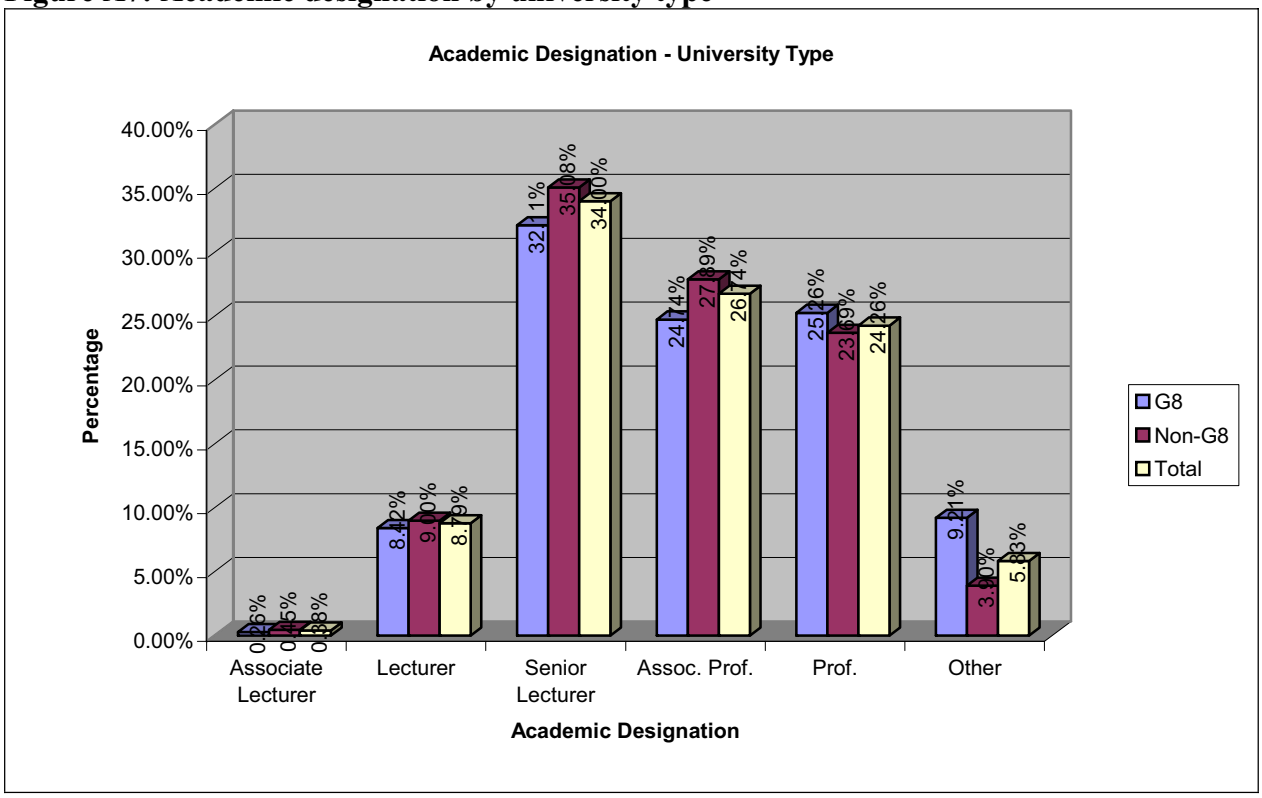
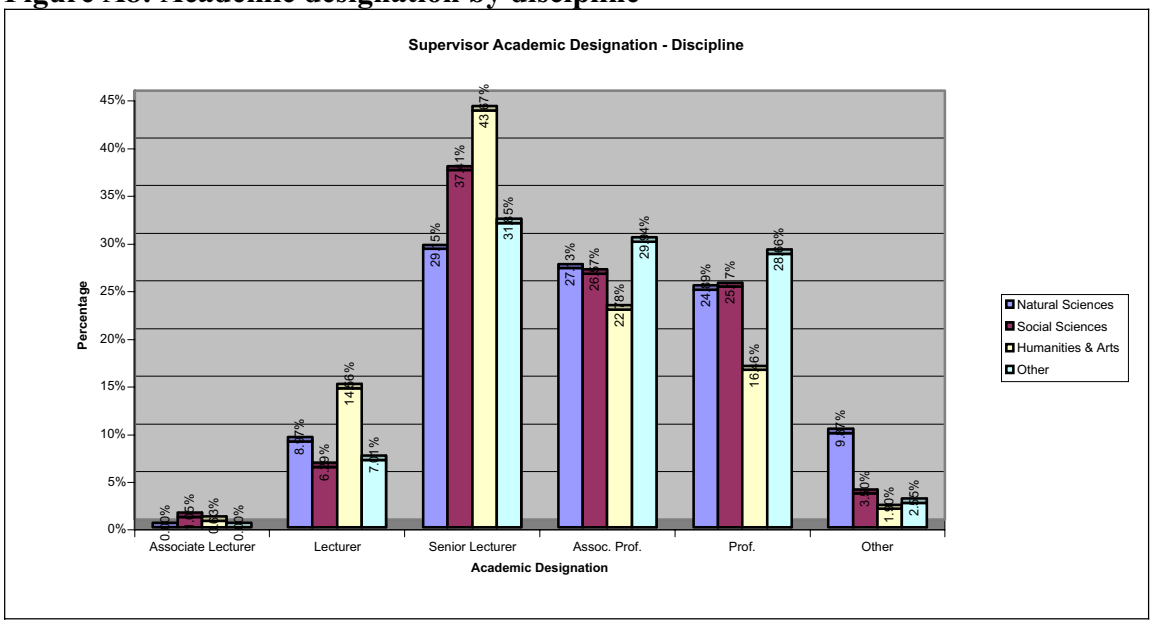


Figure A8: Academic designation by discipline



Supervisors' publications

Single-authored books

Two-hundred and ninety-seven respondents (28.33%) had published at least one single-authored book. Of these, 73.4 per cent had published one or two books. Supervisors from non-Go8 universities reported publishing comparatively more single-authored books than those in Go8 universities (see Table A4).

More than two-thirds of supervisors from the Humanities & Arts reported single authoring books. Fewer than 10 per cent of supervisors from the Natural Sciences reported doing so (see Table A6).

Table A4: Publications by university type—percentage of respondents

	Go8 % of respondents	**Non-Go8** % of respondents	**Total** % of respondents
Single-authored books	24.47	30.54	28.3
Co-authored books	36.58	42.07	40.1
Co-authored books with present or former PhD candidates	5.79	5.99	5.9
Sole edited international collections	12.63	11.23	11.7
Co-edited international collections	30.53	27.10	28.3
Co-edited collections with present or former PhD candidates	4.47	4.04	4.2
Internationally refereed sole authored papers	70.00	75.75	73.7
Internationally refereed co-authored journal papers	87.63	83.83	85.2
Internationally refereed co-authored papers with present or former PhD candidates	71.05	59.73	63.8
Refereed papers solo presented at international conferences	65.53	69.46	68.0
Refereed papers co-presented at international conferences	63.68	62.87	63.2
Refereed papers co-presented at international conferences with present or former PhD candidates	54.47	47.31	49.9

Table A5: Publications by university type—mean number of publications

	Go8 mean number of publications	**Non-Go8** mean number of publications	**Total** mean number of publications
Single-authored books	2.02	1.98	1.99
Co-authored books	2.37	2.68	2.58
Co-authored books with present or former PhD candidates	2.09	1.45	1.68
Sole edited international collections	2.44	1.85	2.08
Co-edited international collections	2.72	2.31	2.47
Co-edited collections with present or former PhD candidates	3.71	2.30	2.84
Internationally refereed sole authored papers	10.89	11.06	11.00
*Internationally refereed co-authored journal papers**	50.08	28.64	36.64
*Internationally refereed co-authored papers with present or former PhD candidates**	29.01	16.24	21.39
Refereed papers solo presented at international conferences	12.10	10.99	11.38
*Refereed papers co-presented at international conferences**	27.82	15.85	20.23
*Refereed papers co-presented at international conferences with present or former PhD candidates**	21.03	11.22	15.11

*Differences significant at $\alpha = 0.01$

Co-authored books

Four-hundred and twenty respondents (40.%) had published co-authored books. Of these, 81 per cent had published three or fewer books. Supervisors from non-Go8 universities were more likely to have published co-authored books than those from Go8 universities (see Table A4).

In the case of co-authored books supervisors from the Social Sciences reported the highest level of co-authorship (see Table A6). In contrast with single-authored books, Humanities &

Arts co-authorship declined relative to single authorship, while Natural Sciences co-authorship increased more than three-fold (see Table A6).

Table A6: Publications by discipline—percentage of respondents

	Natural Sciences % of respondents	**Social Sciences** % of respondents	**Humanities & Arts** % of respondents	**Other** % of respondents	**Total** % of respondents
Single-authored books	8.296	44.95	68.35	14.65	28.3
Co-authored books	30.94	54.70	44.94	34.39	40.1
Co-authored books with present or former PhD candidates	6.95	5.23	5.06	5.10	5.9
Sole edited international collections	7.62	14.98	17.09	12.10	11.7
Co-edited international collections	22.42	35.89	32.28	27.39	28.3
Co-edited collections with present or former PhD candidates	4.04	4.53	3.80	4.46	4.2
Internationally refereed sole authored papers	64.13	85.02	85.44	68.15	73.7
Internationally refereed co-authored journal papers	97.31	82.93	48.10	92.36	85.2
Internationally refereed co-authored papers with present or former PhD candidates	91.48	44.25	16.46	68.79	63.8
Refereed papers solo presented at international conferences	59.42	74.56	75.32	73.25	68.0
Refereed papers co-presented at international conferences	74.22	59.23	29.11	73.25	63.2
Refereed papers co-presented at international conferences with present or former PhD candidates	65.25	36.59	15.82	64.97	49.9

Table A7: Publications by discipline—mean number of publications

	Natural Sciences mean number of publications	Social Sciences mean number of publications	Humanities & Arts mean number of publications	Other mean number of publications	Total mean number of publications
Single-authored books	1.46	19.5	2.15	2.39	1.99
Co-authored books	2.24	3.08	2.42	2.19*	2.58
Co-authored books with present or former PhD candidates	2.03	1.47	1.00	1.38	1.68
Sole edited international collections	2.59	1.98	1.70	1.95	2.08
Co-edited international collections	2.79	2.24	1.71	3.21	2.47
Co-edited collections with present or former PhD candidates	3.61	1.54	1.00	4.86	2.84
Internationally refereed sole authored papers[a]	10.53	11.33	14.05	7.66	11.00
Internationally refereed co-authored journal papers[b]	54.98	17.23	4.16	30.59	36.64
Internationally refereed co-authored papers with present or former PhD candidates[b]	28.30	8.06	2.04	15.65	21.39
Refereed papers solo presented at international conferences	9.92	12.31	10.78	13.63	11.38
Refereed papers co-presented at international conferences[b]	24.89	13.32	3.83	23.58	20.23
Refereed papers co-presented at international conferences with present or former PhD candidates	18.32	9.95	2.40	14.34	15.11

[a]Differences significant at $\alpha = 0.05$

[b]Differences significant at $\alpha = 0.01$Co-authored books with present or former PhD candidates

Only 62 respondents (6%) reported co-authoring books with present or former PhD candidates. 86 per cent of these had published one or two books. There was little difference between non-Go8 and Go8 universities (see Table A4). Nor was there much difference in relation to disciplines, although supervisors in the Natural Sciences engage in this practice the most (see Table A6).

Sole edited international collections

One-hundred and twenty-three respondents (12%) had published sole edited international collections. Of these 84 per cent had published one or two collections. This practice is a little more common in Go8 universities in comparison with non-Go8 universities (see Table A4), and more than twice as common in the Humanities & Arts than it is in the Natural Sciences (see Table A6).

Co-edited international collections

Two-hundred and ninety-seven respondents (28%) had published co-edited international collections. Of these, 86.2 per cent had published three collections or fewer. This practice is comparatively more common in Go8 universities in comparison with non-Go8 universities (see Table A4), and occurs most often in the Social Sciences (see Table A6). Analysis of Variance of the mean number of publications per supervisor by discipline resulted in statistically significant differences (α =0.05). That is, while more Social Sciences supervisors co-edited collections, Natural Sciences supervisors and supervisors in Other disciplines had a greater volume of collections.

Co-edited collections with present or former PhD candidates

Only 44 respondents (4%) had published co-edited international collections with present or former PhD candidates. Of these, 75 per cent had published one or two collections. Analysis of Variance of the mean number of publications per supervisor by discipline resulted in statistically significant differences (α =0.05). That is, while more Social Sciences supervisors co-edited collections with former candidates, Natural Sciences supervisors and supervisors in Other disciplines had a greater volume of collections.

Internationally refereed sole authored papers

Seven-hundred and seventy-two respondents (74%) had published internationally refereed sole authored papers. Of these, 90 per cent had published 24 papers or fewer. This practice is more common in non-Go8 universities in comparison with Go8 universities (see Table A4), and more common in the Humanities & Arts and the Social Sciences than it is in the Natural Sciences (see Table A6). Analysis of Variance of the mean number of publications per supervisor by discipline resulted in statistically significant differences (α =0.01).

Internationally refereed co-authored journal papers

Eight-hundred and ninety-three respondents (85%) had published internationally refereed co-authored journal papers. Of these, 40 per cent had published 12 papers or fewer and 90 per cent had up to 100 papers. Co-authorship of internationally refereed papers is more common in Go8 universities than it is in non-Go8 universities (see Table A4). It is ubiquitous among supervisors in the Natural Sciences (see Table A6) while fewer than half of the supervisors in the Humanities & Arts are so engaged. Using Analysis of Variance to determine differences in the mean number of publications per supervisor according to both university type and discipline, differences were found to be statistically significant (α =0.01). That is, more Go8 supervisors published a greater volume of co-authored internationally refereed papers than those in non-Go8 universities. As well, those in the Natural Sciences published a greater volume of co-authored internationally refereed papers than those in the Social Sciences, Humanities & Arts and Other disciplines.

Internationally refereed co-authored papers with present or former PhD candidates

Six-hundred and sixty-nine respondents (64%) had published internationally refereed co-authored papers with present or former PhD candidates. Of these, 40 per cent had published five papers or fewer and 90 per cent had up to 50 papers. This practice is more common in Go8 universities in comparison with non-Go8 universities (see Table A4). Using Analysis of Variance to determine differences in the mean number of publications per supervisor according to both university type and discipline, differences were found to be statistically significant (α =0.01). That is, more Go8 supervisors published a greater volume of co-authored internationally refereed papers with PhD candidates than did supervisors in non-Go8 universities. As well, supervisors in the Natural Sciences published a greater volume of co-authored internationally refereed papers with present or former PhD candidates than supervisors in the Social Sciences, Humanities & Arts and Other disciplines.

The practice occurs more than twice as often in the Natural Sciences in comparison with the Social Sciences, and five times more often in comparison with the Humanities & Arts (see Table A6).

Refereed papers solo presented at international conferences

Seven-hundred and thirteen respondents (68%) of supervisors reported solo presenting refereed papers at international conferences. Of these, 50 per cent presented five papers or fewer and 90 per cent had up to 25 papers. This practice is more common in non-Go8 universities in comparison with Go8 universities (see Table A4), and it is considerably more common in the Humanities & Arts and the Social Sciences than it is in the Natural Sciences (see Table A6).

Refereed papers co-presented at international conferences

Six-hundred and sixty-two respondents (63%) had refereed papers co-presented at international conferences. Of these, 53 per cent had presented 10 papers or fewer and 90 per cent had up to 50 papers. This practice is slightly more common in Go8 universities than it is in non-Go8 universities (see Table A4). Using Analysis of Variance to determine differences in the mean number of refereed papers presented per supervisor according to both university type and discipline, differences were found to be statistically significant (α =0.01). That is, more Go8 supervisors presented a greater volume of co-presented refereed papers at international conferences than those in non-Go8 universities. As well, those in the Natural Sciences published a greater volume of co-presented refereed papers at international conferences than supervisors in the Social Sciences, Humanities & Arts and Other disciplines.

The practice is most common in the Natural Sciences (see Table A6), and occurs more often in this discipline than does solo presentation. Comparison of data contained in Table A4 further suggests that co-presentation occurs less often in the Social Sciences than does solo presentation, and far less often in the case of the Humanities & Arts than does solo presentation.

Refereed papers co-presented at international conferences with present or former PhD candidates

Five-hundred and twenty-three respondents (50%) had refereed papers co-presented at international conferences with PhD candidates. Of these, 80 per cent had presented five papers or fewer. This practice is more common in Go8 universities than it is in non-Go8

universities (see Table A4). Using Analysis of Variance to determine differences in the mean number of refereed papers presented per supervisor according to both university type and discipline, differences were found to be statistically significant (α =0.01). That is, more Go8 supervisors presented a greater volume of co-presented refereed papers at international conferences with PhD candidates than those in non-Go8 universities. As well, those in the Natural Sciences published a greater volume of co-presented refereed papers at international conferences with PhD candidates than did supervisors in the Social Sciences, the Humanities & Arts and Other disciplines.

The practice occurs four times more often in the Natural Sciences than it does in the Humanities & Arts (see Table A6). Comparison of data contained in Table A6 suggests that in relation to this form of published research communication, collaboration between supervisor and candidate is greatest in the Natural Sciences, quite evident in the Social Sciences and fairly minimal in the Humanities & Arts.

In terms of research publications overall, disciplinary publications data suggest that:

- Single authorship of all types of research communication is more common in the Humanities & Arts than it is in the Social Sciences, while in comparison with the Natural Sciences it is far more frequent.
- Social Scientific research practice is more collaborative in terms of co-authorship than it is the Humanities & Arts, but it is less collaborative than Natural Scientific research practice.
- Co-authored research collaborations with present or former PhD candidates are common in the Natural Sciences, occur less frequently in the Social Sciences and are virtually non-existent in the Humanities & Arts.

If one takes the view that a significant part of any PhD candidature is learning how to communicate research with one's disciplinary peers at an internationally refereed standard, then it would appear that PhD supervision in the Natural Sciences is the most efficacious in this regard while PhD supervision in the Humanities & Arts is least efficacious. In terms of the publications data presented, it would further seem that this situation is attributable to an apparent difference between the research cultures of the Natural Sciences and the Humanities & Arts, namely, that Natural Scientific research culture is more collaborative than Humanities & Arts research culture which is quite individualistic. It would seem that Social Scientific research culture contains elements of both sets of these characteristics.

Competitive grants

Table A8: Competitive grants by university type—percentage of respondents

	Go8 % of respondents	**Non-Go8** % of respondents	**Total** % of respondents
ARC large grants	47.11%	43.11%	44.6%
ARC small grants	70.26%	61.83%	64.9%
Competitive/research consultancy grants	52.89%	60.33%	57.6%

Table A9: Competitive Grants by University Type – Mean Number of grants

	Go8 mean number of grants	**Non-Go8** mean number of grants	**Total** mean number of grants
ARC large grants[a]	4.44	3.56	3.90
ARC small grants[b]	4.13	3.21	3.57
Competitive/research consultancy grants	9.28	8.48	8.75

[a]Differences significant at $\alpha = 0.05$
[b]Differences significant at $\alpha = 0.01$

Table A10: Competitive grants by discipline—percentage of respondents

	Natural Sciences % of respondents	**Social Sciences** % of respondents	**Humanities & Arts** % of respondents	**Other** % of respondents	**Total** % of respondents
ARC large grants	55.16	40.07	32.91	34.39	44.6
ARC small grants	71.08	65.51	56.96	54.14	64.9
Competitive/research consultancy grants	56.05	69.69	32.28	65.61	57.6

Table A11: Competitive grants by discipline—mean number of grants

	Natural Sciences mean number of grants	**Social Sciences** mean number of grants	**Humanities & Arts** mean number of grants	**Other** mean number of grants	**Total** mean number of grants
ARC large grants[a]	5.11	2.59	1.60	3.37	3.90
ARC small grants[a]	4.55	2.76	2.31	3.02	3.57
Competitive/research consultancy grants[a]	10.66	7.24	4.86	8.96	8.75

[a]Differences significant at $\alpha = 0.01$

ARC large grants

Four-hundred and sixty-seven respondents (45%) had been awarded ARC large grants. Of these, 80 per cent had received five or fewer. Supervisors in Go8 universities reported winning more of these grants than did supervisors working in non-Go8 universities (see Table A9). Supervisors in the Natural Sciences reported winning more of these grants than their counterparts in the Social Sciences, who in turn reported winning more of these grants than did supervisors in the Humanities & Arts (see Table A11).

ARC small grants

Six-hundred and eighty respondents (65%) had been awarded ARC small grants. Of these, 75 per cent had received four or fewer. Similar patterns in terms of differences between university types and disciplines were reported in respect of these grants as were reported in the case of Large ARC Grants (see Tables 8 to 11).

Competitive/research consultancy grants

Email responses to the survey and follow-up interviews with supervisors indicate that these data may be incomplete in two respects. First, the survey specified ARC grants as a category and assumed that National Health and Medical Research Council grants would be recorded in responses to the competitive research/consultancy item. Feedback from respondents indicates that this assumption did not resonate with all respondents. Second, additional feedback from respondents indicates that the word 'competitive' was interpreted literally by some, who did not record research that involved successfully procuring support directly from industry (state and private), because this mode of attracting research income is not 'competitive' in the sense of ARC or other grant schemes.

Nonetheless, 604 respondents (58%) had been awarded Competitive/Research Consultancy grants. Of these, 70 per cent had received eight or fewer. Greater winnings were reported by non-Go8 supervisors than were reported by Go8 supervisors (see Table A9).

Supervisors in the Social Sciences reported greater winnings in this area than did supervisors in the Natural Sciences, and supervisors in the Natural Sciences reported greater winnings than did supervisors in the Humanities & Arts (see Table A11). These data indicate that supervisors in the Social Sciences are more engaged in attracting research income from sources outside the ARC.

Taken as a whole, these data about sources of external research income indicate that externally funded and larger scale research is more commonly won in the Natural Sciences than it is in the Social Sciences and the Humanities & Arts. When combined with Publications data, overall, it seems that:

- Natural Scientific research culture is collaborative and competitively oriented and/or successful in pursuing external research funding.
- Humanities & Arts research culture is individualistic and is somewhat indifferent and/or unsuccessful in pursuing external research funding.
- Social Scientific research culture contains a blend of Natural Sciences and Humanities & Arts characteristics and orientations, with mixed results.

If one presumes that a significant aspect of PhD supervision involves familiarising candidates with the winning of ARC grants and engaging in competition for the purposes of securing

research support, then these data imply that such learning is most likely to take place within the Natural Sciences and is least likely to take place in the Humanities & Arts.

Second survey

There were some data conflicts between the initial survey and the second survey. This is the result of respondents self-reporting. The primary conflict was the increased numbers of candidates reported.

Scholarships

Eighty-six per cent of candidates who were reported as scholarship holders by respondents were identified as having been conferred with a PhD. Scholarship holders identified as being conferred represented 87 per cent of Natural Science candidates, 84 per cent of Social Science candidates, 79 per cent of Humanities & Arts candidates, and 90 per cent of Other candidates. Using chi^2 testing techniques these differences were found to be statistically significant. Eighty-five per cent of Go8 candidates who were scholarship holders were identified as having been conferred with a PhD and 86 per cent of non-Go8 candidates who were scholarship holders were identified as having been conferred with a PhD.

Comparison of these data with overall completions data suggest three things:

- Across university types and disciplines the likelihood of completion is enhanced by possession of a scholarship.
- Non-Go8 candidates derive greater benefit from possession of a scholarship than Go8 candidates.
- Candidates in the Social Sciences, Humanities & Arts and Other disciplines derive greater benefit from possession of a scholarship than candidates in the Natural Sciences.

Full-time/part-time candidatures

Full-time candidates are more likely to complete than part-time candidates (see Table A12). full-time candidates are more likely to complete in circumstances where they do not:

- change supervisors
- change their topic after the first year of candidature
- take leave of absence.

In other words, conceptual and temporal continuity of candidature and supervision contributes to the likelihood of completion. This effect holds across university types (see Table A13), and across disciplines (see Table A14).

Table A12: Comparison of full- and part-time candidatures

	Full-time %	Part-time %
How many of the PhD candidates that you supervised over the period 1990–97 held candidatures that were predominantly	60.99	39.01
Of those who were conferred, how many candidates were	62.56	37.44
Of those conferred between 1990–97 how many did not change supervisors	61.68	38.32
How many did not change their topic substantially after their first year	61.95	38.05
How many candidates (1990–97) completed without taking leave of absence	63.09	63.09
How many candidates (1990–97) were scholarship holders	61.35	38.65

Table A13: Comparison of full- and part-time candidatures by university type

	Go8		Non Go8	
	Full-time %	Part-time %	Full-time %	Part-time %
How many of the PhD candidates that you supervised over the period 1990–97 held candidatures that were predominantly	65.47	34.53	57.83	42.17
Of those who were conferred, how many candidates were	66.78	33.22	59.49	40.51
Of those conferred between 1990–97 how many did not change supervisors	66.46	33.54	58.11	41.89
How many did not change their topic substantially after their first year	66.56	33.44	58.48	41.52
How many candidates (1990–97) completed without taking leave of absence	66.71	33.29	60.46	39.54
How many candidates (1990–97) were scholarship holders	66.69	33.31	57.51	42.49

Table A14: Comparison of full- and part-time candidatures by discipline—percentage of students

	Natural Sciences		Social Sciences		Humanities & Arts		Other	
	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time
How many of the PhD candidates that you supervised over the period 1990–97 held candidatures that were predominantly	71.64	28.39	48.25	51.75	52.7	47.26	59.5%	40.50
Of those who were conferred, how many candidates were	70.44	29.56	51.61	48.38	54.5	45.45	61.0	38.96
Of those conferred between 1990–97 how many did not change supervisors	69.77	30.23	50.77	49.23	53.6	46.40	59.5	40.50
How many did not change their topic substantially after their first year	69.91	30.09	51.01	48.99	53.8	46.15	59.6	40.34
How many candidates (1990–97) completed without taking leave of absence	70.58	29.42	52.91	47.09	55.3	44.67	60.2	39.80
How many candidates (1990–97) were scholarship holders	67.52	32.48	53.42	46.58	52.0	47.98	59.2	40.71

Note: This table is duplicated as Table 6.

Candidate selection policy/protocols at the level of supervisors' organisational units

Three-quarters of supervisors indicated that their organisational unit (School / Department / Faculty / Research Centre) employs policy/protocols for selecting PhD candidates (see Table A15). The Social Sciences, Humanities & Arts and Other disciplines have a higher incidence of policy for selecting candidates at the level of supervisors' organisational units (see Table A17). A similar pattern is evident between non-Go8 versus Go8 universities (see Table A16).

Table A15: Policies for selection of PhD candidates

	Number	Valid %	Cumulative %
Yes	425	75.2	75.2
No	102	18.1	93.3
Don't know / no response	38	6.7	100.0
Total	565	100.0	

In relation to disciplinary data about completion rates and submission times, the data contained in Table A16 may indicate that the greater incidence of candidate selection policies at the level of the organisational unit in the Social Sciences and the Humanities & Arts does not necessarily translate into more completions and faster submissions in these disciplines.

Table A16: Policies for selection of PhD candidates by university type

	Go8 %	Non-Go8 %	Total %
Yes	71.6	77.6	75.2
No	21.8	16.0	18.1
Don't know / no response	7.2	6.4	6.7
Total	100	100	100

Table A17: Policies for selection of PhD candidates by discipline

	Natural Sciences %	Social Sciences %	Humanities & Arts %	Other %	Total %
Yes	68.6	82.6	78.5	79.3	75.2
No	23.1	10.7	17.7	15.9	18.1
Don't know / no response	8.2	6.7	3.8	4.9	6.7
Total	100	100	100	100	100

Note: Significant at $\alpha = 0.05$

Candidate supervision policy/protocols at the level of supervisors' organisational units

Nearly three-quarters of supervisors indicated that their organisational unit employs policy/protocols for selecting PhD candidates (see Table A15). The incidence of candidate supervision policy/protocols is uniform across disciplines (see Table A19) and university types (see Table A20), at the level of supervisors' organisational units.

Table A18: Policies for supervision of candidates

	Number	Valid %	Cumulative %
Yes	418	74.0	74.0
No	116	20.5	94.5
Don't know / no response	31	5.5	100.0
Total	565	100.0	

Table A19: Policies for supervision of candidates by university type

	Go8 %	Non-Go8 %	Total %
Yes	70.3	76.4	74.0
No	24.3	18.1	20.5
Don't know / no response	5.4	5.5	5.5
Total	100	100	100

Table A20: Policies for supervision of candidates by discipline

	Natural Sciences %	Social Sciences %	Humanities & Arts %	Other %	Total %
Yes	74.1	73.2	77.2	72.0	74.0
No	20.7	20.8	16.5	23.2	20.5
Don't know / no response	5.1	6.0	6.3	4.9	5.5
Total	100	100	100	100	100

Supervisor training policy/protocols at the level of supervisors' organisational units

Fifty-five per cent of supervisors indicated that their organisational *does not* follow policy/protocols for training PhD supervisors (see Table A21). The prevalence of such policy is greater in the Social Sciences and the Humanities & Arts than it is in the Natural Sciences (see Table A22), although this difference is not statistically significant. The prevalence of such policy is greater in non-Go8 universities than it is in Go8 universities (see Table A23), and this difference is statistically significant. In relation to data about completion rates and submission times by University Type, the data contained in Table A23 may indicate that a greater incidence of supervisor training policy at the level of supervisors' organisational units does not necessarily translate into more completions and faster submissions in Go8 universities.

Table A21: Supervisor training policies

	Number	Valid %	Cumulative %
Yes	201	35.6	35.6
No	311	55.0	90.6
Don't know / no response	53	9.4	100.0
Total	565	100.0	

Table A22: Supervisor training policies by university type

	Go8 %	Non-Go8 %	Total %
Yes	27.9	40.6	35.6
No	62.6	50.1	55.0
Don't know / no response	9.5	9.3	9.4
Total	100	100	100.0

Note: Significant at $\alpha = 0.01$

Table A23: Supervisor training policies by discipline

	Natural Sciences %	Social Sciences %	Humanities & Arts %	Other %	Total %
Yes	30.2	39.6	39.2	41.5	35.6
No	59.2	52.3	53.2	48.8	55.0
Don't know / no response	10.6	8.1	7.6	9.8	9.4
Total	100.0	100.0	100.0	100.0	100.0

Frequency of face-to-face meetings with full-time PhD candidates

Fifty-six per cent of supervisors reported that face-to-face meetings with their full-time PhD candidates occur at least on a weekly basis (see Table A24). The frequency of face-to-face meetings between supervisor and candidate on at least a weekly basis is slightly higher in Go8 universities than it is in non-Go8 universities, especially twice a week interaction (see Table A25). Forty-eight per cent of supervisors in the Natural Sciences reported meeting their full-time candidates at least twice a week, compared with 6 per cent of supervisors in the Social Sciences, 1 per cent of supervisors in the Humanities & Arts and 24 per cent of supervisors in Other disciplines (see Table A26). Weekly or more frequent meetings occur twice as often in the Natural Sciences in comparison with the Social Sciences, and almost four times more often in comparison with the Humanities & Arts.

Table A24: Frequency of face-to-face meetings with full-time PhD candidates

	Number	Valid %	Cumulative %
2+ times per week	155	27.2	27.2
Weekly	167	29.3	56.6
Fortnightly	143	25.1	81.7
Monthly	63	11.1	92.8
Less than monthly	7	1.2	94.0
Don't know / no response	34	6.0	100.0
Total	569	100.0	

Table A25: Frequency of face-to-face meetings with full-time PhD candidates by university type

	Go8 %	Non-Go8 %	Total %
2+ times per week	34.4	22.2	27.0
Weekly	25.4	32.1	29.5
Fortnightly	27.2	23.9	25.2
Monthly	9.8	12.0	11.1
Less than monthly		2.0	1.2
Don't know / no response	3.1	7.9	6.0
Total	100.0	100.0	100.0

Note: Differences significant at $\alpha = 0.01$

Table A26: Frequency of face-to-face meetings with full-time PhD candidates by discipline

	Natural Sciences %	Social Sciences %	Humanities & Arts %	Other %	Total %
2+ times per week	48.2	6.0	1.2	24.4	27.0
Weekly	29.4	32.9	18.5	34.1	29.5
Fortnightly	14.9	33.6	44.4	23.2	25.2
Monthly	4.3	16.8	27.2	6.1	11.1
Less than monthly	.4	2.7	1.2	1.2	1.2
Don't know '/ no response	2.7	8.1	7.4	11.0	6.0
Total	100.0	100.0	100.0	100.0	100.0

Note: Differences significant at $\alpha = 0.01$

These data imply that the distance between supervisors and full-time candidates at the level of localised interaction is quite small in the Natural Sciences, somewhat evident in the Social Sciences and considerable in the Humanities & Arts.

Frequency of face-to-face meetings with part-time PhD candidates

A majority of supervisors (56%) reported meeting face-to-face with their part-time candidates at least monthly, with most of this interaction happening between fortnightly and monthly (see Table A27). This interactional pattern is slightly more prevalent in non-Go8 universities than it is in Go8 universities (see Table A28). It is also more prevalent in the Humanities & Arts, Social Sciences and Other disciplines than it is in the Natural Sciences (see Table A29). Conversely, weekly and twice weekly interaction is more common in the Natural Sciences. The 44 per cent 'Don't know/no response' rate in the Natural Sciences is probably a function

of the comparatively smaller proportion of part-time candidates undertaking PhDs in this discipline.

Table A27: Frequency of face-to-face meetings with part-time PhD candidates

	Number	Valid %	Cumulative %
2+ times per week	17	3.0	3.0
Weekly	42	7.4	10.4
Fortnightly	113	19.9	30.2
Monthly	146	25.7	55.9
Less than monthly	78	13.7	69.6
Don't know / no response	173	30.4	100.0
Total	569	100.0	

Table A28: Frequency of face-to-face meetings with part-time PhD candidates by university type

	Go8 %	Non-Go8 %	Total %
2+ times per week	1.8	3.8	3.0
Weekly	7.6	7.3	7.4
Fortnightly	18.8	20.7	19.9
Monthly	22.3	28.0	25.7
Less than monthly	9.8	16.3	13.8
Don't know / no response	39.7	23.9	30.2
Total	100.0	100.0	100.0

Note: Differences significant at $\alpha = 0.01$

Table A29: Frequency of face-to-face meetings with part-time PhD candidates by discipline

	Natural Sciences %	Social Sciences %	Humanities & Arts %	Other %	Total %
2+ times per week	4.3	1.3		4.9	3.0
Weekly	11.8	3.4	2.5	6.1	7.4
Fortnightly	17.3	23.5	18.5	23.2	19.9
Monthly	14.1	30.9	53.1	25.6	25.7
Less than monthly	8.2	24.2	16.0	9.8	13.8
Don't know / no response	44.3	16.8	9.9	30.5	30.2
Total	100.0	100.0	100.0	100.0	100.0

Note: Differences significant at $\alpha = 0.01$

Frequency of electronic meetings with full-time PhD candidates

A majority of supervisors (55%) reported meeting electronically (telephone/conference, email, internet) with their full-time candidates at least weekly (see Table A30). More than one-quarter reported such interaction at least twice a week. Weekly interactions of this sort occur most often among supervisors in non-Go8 universities, while twice-weekly meetings occur most often in Go8 universities (see Table A31). A similar pattern is evident between disciplines. Weekly meetings are most likely to occur in the Social Sciences and the Humanities & Arts. Twice weekly meetings are most likely to occur in the Natural Sciences and Other disciplines (see Table A32).

Table A30: Frequency of electronic meetings with full-time PhD candidates

	Number	Valid %	Cumulative %
2+ times per week	162	28.5	28.5
Weekly	151	26.5	55.0
Fortnightly	76	13.4	68.4
Monthly	28	4.9	73.3
Less than monthly	70	12.3	85.6
Don't know / no response	82	14.4	100.0
Total	569	100.0	

Table A31: Frequency of electronic meetings with full-time PhD candidates by university type

	Go8 %	Non-Go8 %	Total %
2+ times per week	30.8	26.8	28.4
Weekly	24.6	28.0	26.6
Fortnightly	13.4	13.4	13.4
Monthly	4.5	5.2	4.9
Less than monthly	11.2	13.1	12.3
Don't know / no response	15.6	13.4	14.3
Total	100.0	100.0	100.0

Table A32: Frequency of electronic meetings with full-time PhD candidates by discipline

	Natural Sciences %	Social Sciences %	Humanities & Arts %	Other %	Total %
2+ times per week	38.0	13.4	11.1	42.7	28.4
Weekly	22.0	36.2	28.4	22.0	26.6
Fortnightly	7.8	19.5	25.9	7.3	13.4
Monthly	3.5	6.0	12.3		4.9
Less than monthly	15.7	8.1	12.3	9.8	12.3
Don't know / no response	12.9	16.8	9.9	18.3	14.3
Total	100.0	100.0	100.0	100.0	100.0

Note: Differences significant at $\alpha = 0.01$

Frequency of electronic meetings with part-time PhD candidates

Forty-two per cent of supervisors reported that they meet electronically with their part-time candidates on at least a fortnightly basis (see Table A33). The frequency of this level of interaction is greater in non-Go8 universities than it is in Go8 universities (see Table A34). The same applies for Other disciplines, the Social Sciences and the Humanities & Arts in comparison with the Natural Sciences (see Table A35). Electronic contact with part-time candidates on a weekly basis is uniform across disciplines. Twice weekly contact is more prevalent in Other disciplines and the Natural Sciences than it is in the Social Sciences and the Humanities & Arts. The 46 per cent 'Don't know/no response' rate in the Natural Sciences is probably a function of the comparatively smaller proportion of part-time candidates undertaking PhDs in this discipline.

Table A33: Frequency of electronic meetings with part-time PhD candidates

	Number	Valid %	Cumulative %
2+ times per week	53	9.3	9.3
Weekly	93	16.3	25.7
Fortnightly	95	16.7	42.4
Monthly	75	13.2	55.5
Less than monthly	61	10.7	66.3
Don't know / no response	192	33.7	100.0
Total	569	100.0	

Table A34: Frequency of electronic meetings with part-time PhD candidates by university type

	Go8 %	Non-Go8 %	Total %
2+ times per week	9.4	9.3	9.3
Weekly	16.1	16.6	16.4
Fortnightly	10.7	20.7	16.8
Monthly	10.7	14.9	13.2
Less than monthly	8.5	12.2	10.8
Don't know / no response	44.6	26.2	33.5
Total	100.0	100.0	100.0

Note: Differences significant at $\alpha = 0.01$

Table A35: Frequency of electronic meetings with part-time PhD candidates by discipline

	Natural Sciences %	Social Sciences %	Humanities & Arts %	Other %	Total %
2+ times per week	11.0	3.4	6.2	18.3	9.3
Weekly	13.7	20.1	12.3	22.0	16.4
Fortnightly	10.6	24.8	25.9	12.2	16.8
Monthly	8.6	16.1	24.7	11.0	13.2
Less than monthly	10.2	12.8	12.3	7.3	10.8
Don't know / no response	45.9	22.8	18.5	29.3	33.5
Total	100.0	100.0	100.0	100.0	100.0

Note: Differences significant at $\alpha = 0.01$

Taken as a whole, survey data referring to the frequency of interaction between supervisors and candidates suggest that:

- The interactive distance between supervisors and full-time candidates in terms of both face-to-face and electronic meetings is quite small in the Natural Sciences, somewhat evident in the Social Sciences and quite apparent in the Humanities & Arts.
- To a lesser extent, the same applies in terms of twice weekly and weekly face-to-face and electronic meetings between supervisors and part-time candidates.

If it is presumed that frequency of interaction between supervisor and candidate is integral to PhD supervision that assists the timely completion of candidatures, then these data are consistent with broader disciplinary data referring to completion rates and submission times.

Number of theses examined

All supervisors had examined at least one PhD thesis. Eighty per cent had examined 10 or fewer theses. There were no statistical differences between the number examined according to university type or discipline. There were statistically significant differences according to academic designation with those with a higher academic designation examining more theses.

Success rate

A nominal success rate for supervisors was calculated as the ratio of the number of candidates conferred with a PhD to the total number of candidates supervised:

$$SuccessRate = \frac{NumberOfCandidatesConferred}{NumberOfCandidatesSupervised}$$

This measure was used to determine the factors that affect whether a student will complete. Success rate of supervisors is shown in Figure A9. There is a large peak at 100 per cent with 30 per cent of supervisors having a perfect success rate. Smaller peaks occur at zero and 50 per cent. Examination of those supervisors with a zero success rate showed that they had candidates who had submitted their thesis but had not, as yet, been conferred with a degree. There appeared to be no explanation for the peak at 50 per cent, as it occurred when data was separated according to university type, discipline and academic designation.

Figure A10 shows cumulative percentage data for success rates. From this graph it can be seen that 40 per cent of supervisors have a success rate of 50 per cent or less, another 20 per cent have a success rate between 50 per cent and 82 per cent, 6 per cent of supervisors have a success rate between 82 per cent and 95 per cent. 34 per cent of supervisors have a 100 per cent success rate.

Figure A9: Success rate of supervisors

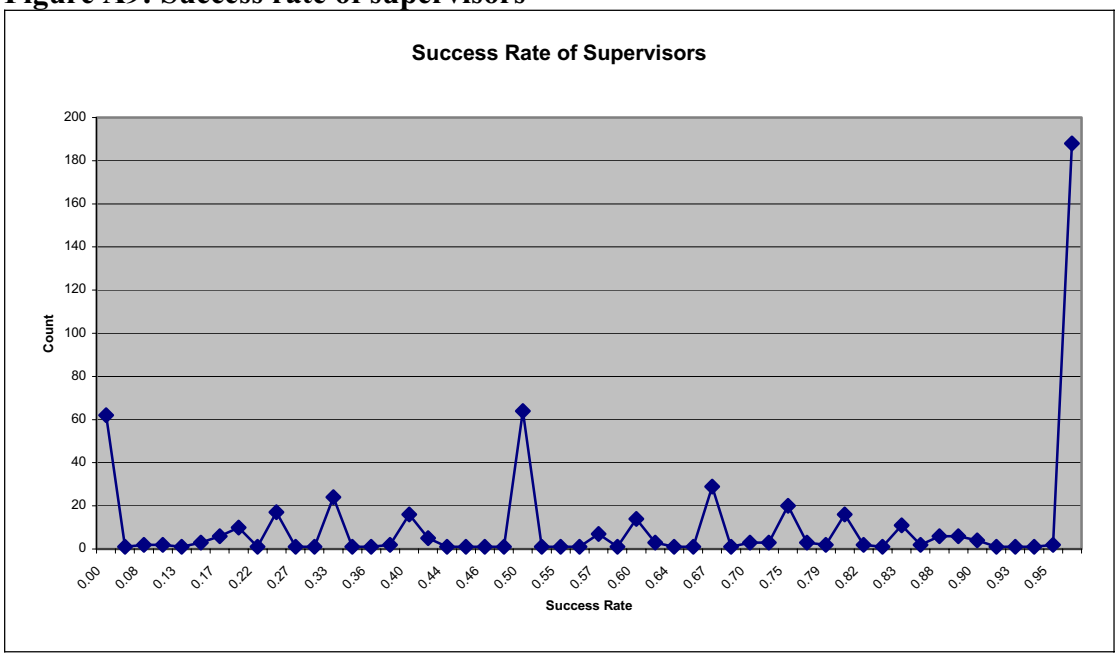
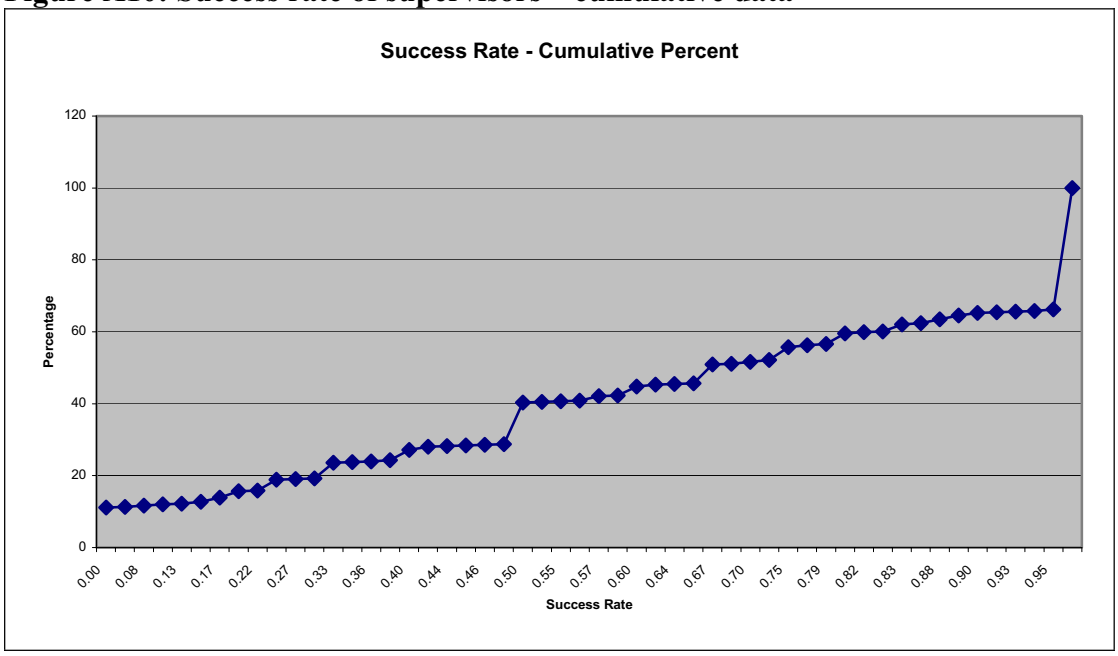


Figure A10: Success rate of supervisors—cumulative data



Bivariate correlation showed that the success rate for a supervisor was correlated with a number of variables from the questionnaire (see Table A36). A supervisor's success rate correlates with:

- How long the supervisor had been supervising PhD candidates.
- The completion times of PhD candidates.
- The number of sole edited international collections published
- The number of internationally refereed journal papers published with present or former PhD candidates.
- The number of internationally refereed co-author journal papers published.
- The number of refereed papers co-presented at international conferences.
- The number of refereed papers co-presented at international conferences with present or former PhD candidates.
- The number of Large ARC grants won.
- The number of Small ARC grants won.
- The number of full-time candidates who did not change supervisors.
- The number of full-time candidates who did not change their topic substantially after their first year.
- The number of full-time candidates who completed without taking leave of absence.
- The number of PhD theses examined.

Supervisors' publications activity is highly significant. These data indicate that supervisors' activities in the publication of sole-edited collections are negatively correlated with completion rates and timely submissions. That is, the more supervisors engage in this activity the greater the likelihood that the candidates they supervise either will not complete or will

take a long time to submit. Conversely, the following are positively correlated with high completion rates and timely submissions:

- Publishing internationally refereed journal papers with present or former PhD candidates.
- Co-authoring internationally refereed journal papers.
- Co-presenting internationally refereed conference papers.
- Co-presenting internationally refereed conference papers with present or former PhD candidates (see Table A36).

Thus, supervisors who had been supervising for longer times, had candidates who completed within five years, published and presented papers with present or former PhD candidates, won larger numbers of ARC Large and Small grants, had full-time candidates who did not change supervisors or topics and did not take leave of absence, and examined more PhD theses had better success rates.

Table A36: Correlations with success rate of supervisors

Question	Pearson's Correlation
I began supervising PhD candidates in (insert year)	.241[a]
How many submitted their thesis in 4–5 years?	.324[a]
How many sole-edited collections have you published?	-.089[b]
How many refereed journal papers have you published with your PhD candidates?	.212[a]
How many refereed co-author journal papers have you published?	.253[a]
How many refereed papers have you co-presented at international conferences?	.119[a]
How many refereed papers have you co-presented at international conferences with your PhD candidates?	.097[b]
How many large ARC grants have you won?	.161[a]
How many small ARC grants have you won?	.133[a]
Of those conferred between 1990–97 how many did not change supervisors - Full time	.279[a]
How many did not change their topic substantially after their first year - Full time	.296[a]
How many candidates (1990–97) completed without taking leave of absence - Full time	.353[a]
How many PhD theses have you examined	.170[a]

[a]Significant at $\alpha = 0.01$
[b]Significant at $\alpha = 0.05$
Note: This table is duplicated as Table 5

In addition, Analysis of Variance was carried out to determine if there were any differences in the mean success rates of supervisors according to the categorical variables gender, academic designation, discipline and university type. There were found to be statistically significant differences between means for gender, academic designation and discipline. There were no statistically significant differences according to university type. Thus women had lower success rates, Lecturers' and Senior Lecturers' success rates were lower, and those working in the Natural Sciences had higher success rates.

Table A37: Mean success rate by gender

Gender	Mean success rate
Male	.6843
Female	.4997
Total	.6382

Note: Significant at $\alpha = 0.01$

Table A38: Mean success rate by academic designation

Academic Designation	Mean success rate
Lecturer	.5086
Senior Lecturer	.5611
Associate Professor	.7082
Professor	.7139
Other	.6635
Total	.6382

Note: Significant at $\alpha = 0.01$

Table A39: Mean success rate by discipline

Discipline	Mean success rate
Natural Sciences	.7235
Social Sciences	.5497
Humanities & Arts	.5068
Other	.6572
Total	.6382

Note: Significant at $\alpha = 0.01$

Table A40: Mean success rate by university type

University type	Mean success rate
Go8	.6644
Non-Go8	.6214
Total	.6382

Further investigation shows that the variables listed in Table A36 are all, with the exception of the number of sole edited collections, positively correlated. This implies that success rate is not simply dependent on these variables but is instead a facet of an academic/research culture that is built upon, and measured by, the ability to publish in a variety of ways, win research grants and develop collaborative networks. In this way, the PhD candidature can be viewed as a *rite of passage* into distinct research cultures.

Appendix 3: Interviews

This appendix provides an overview of interview data. It explains the classification of supervisor ranges and compares and contrasts them in relation to condensations of data that illustrate aspects of each in terms of supervisory practice.

Supervisor classifications

Interview candidates were selected solely on the basis of their association with PhD completions. This involved comparing supervisors' second survey returns, because these data show:

- the numbers of full- and part-time candidates supervised during the 1990–97 period
- the corresponding numbers of these candidates who reportedly completed their degrees

The comparison enabled the categorisation of supervisors across the following ranges referring to PhD completions:

- High-range (HR)
- Mid Range, within which supervisors were further classified as:
    - High mid-range (HMR)
    - Middle mid-range (MMR)
    - Low mid-range (LMR)

Data pertaining to these ranges are now discussed.

High-range supervisors (n = 11)

High-range refers to supervisors who were associated with an average of at least two completions per year over the eight years period 1990–97. These supervisors reported total numbers of completions of 16 or more, with a provisional completion rate of 82 per cent or better.

The interview sample for this range included:

- Eight Go8 and three non-Go8 supervisors.
- Eight Natural Sciences supervisors, two Social Sciences supervisors and one supervisor from 'Other' disciplines.

High-range supervisors share the following characteristics:

- All began supervising PhD candidates prior to 1992.
- All regularly co-author conference and journal papers with their candidates.
- All pursue and win ARC grants and other research income, including as a way of funding PhD candidatures.
- Ten are male.
- Nine are Professors, one is an Associate Professor, one is a Senior Lecturer.

- The eight supervisors working in the Natural Sciences are employed in Go8 universities.

Notably, supervisors working in the Natural Sciences and 'Other' disciplines supervise predominantly full-time candidates. In contrast, the Social Sciences supervisors' complements are predominantly part-time.

High-range supervisors have worked in universities for between 20 and 40 years. They range in age from mid-40s to mid-60s. A majority is in their mid-50s. They developed their supervisory knowledge and skills informally, that is, on-the-job as opposed to via formalised training in PhD supervision. They employ the same modus operandi for conducting research, namely, collaboration. Collaborations are in turn integrated with team-based supervisory practices. Team-based supervision is ever present for Natural Sciences supervisors and the supervisor working in 'Other' disciplines. It is more ad hoc for the two Social Sciences supervisors.

Candidates are organised into cohorts, according to stage of candidature and project theme. Cohorts are used routinely in the Natural Sciences and 'Other' disciplines. They are used when possible in the cases of the two Social Sciences supervisors.

All High-range supervisors expect their candidates to submit in a timely manner. They negotiate expectations about time management and productivity explicitly with their candidates, well within the first year of candidature. The emphasis on time and productivity is stronger and more insistent with the supervisor working in 'Other' disciplines and the Natural Sciences supervisors, but all High-range supervisor work with their candidates on the development of deadlines and milestones related to the routine generation of text. Text generation is the basis for supervisor's and candidate's ongoing monitoring of candidature progression. It also helps to prepare for and satisfy university quality controls (e.g. confirmation of candidature and annual progress reports). It enables collaboration between supervisors and candidates on the production of conference and journal papers, progress reports to industry and thesis chapters. The extent and emphasis on these practices is broader and more urgent among the Natural Sciences supervisors and the supervisor working in 'Other' disciplines, because co-authorship with candidates is customary for them and more of their candidates are undertaking industry-related research that depends on candidates generating results according to agreed deadlines.

High-range supervisors in the Natural Sciences and 'Other' disciplines

The eight supervisors working in the Natural Sciences and the supervisor who identified as working in Other disciplines are associated with research teams comprised of small groups of academics, postdoctoral staff and PhD, Masters by Research and Honours candidates working on related research projects.

All employ postdoctoral staff, via externally earned research income on their accounts. Postdoctoral staff are integral to PhD supervision. As de-facto supervisors they manage day-to-day research operations and provide routine advice and hands-on technical training to candidates.

These High-range Natural Sciences supervisors encourage senior PhD candidates to assist junior PhD as well as Research Masters and Honours candidates. They sometimes consider prospective candidates' predispositions toward teamwork when deciding whether or not to supervise them. They do not take on candidates whose research interests are not closely

aligned with at least an aspect of their own research agenda. They are mostly reluctant to take on candidates who do not have a scholarship. They frequently fund scholarships from their external research winnings and on occasions are willing to fund from their other research income candidates that miss out on scholarships but present as good prospects for successfully completing a PhD. They supervise full-time candidates almost exclusively.

Three High-range Natural Sciences supervisors additionally report that they sometimes encourage and assist their candidates to undertake consultancies and write research grants during the candidature. They believe such activities contribute to the overall candidature because they represent a form of professional development that adds to the candidate's employment prospects outside of as well as within universities.

These supervisors are closely situated to their candidates in terms of geographic proximity. Research often occurs in a laboratory or in particular areas of fieldwork. This assists them to see their candidates informally, for five or so minutes, at least weekly. They also meet candidates more formally, on a weekly or fortnightly basis, in research team and group meetings related to the progress of the team's or group's research agenda. They additionally meet candidates formally in scheduled meetings and on an as-needed basis as well. Typically, scheduled meetings are more frequent in the first year of candidature and at times of intense candidate activity, with less frequent meetings in-between (up to 6 months apart in some cases).

The supervisors insist on the early and ongoing generation of text, even if only in dot point form to begin with. They are also inclined to involve their candidates in experimental work as early as possible, usually while the candidate is simultaneously reading research literature. They tend to negotiate small, achievable milestones with candidates to begin with. As the candidature progresses, broader scale milestones are negotiated. They turn candidates' text around in a one-day to two-week timeframe, ideally overnight. They begin to suspect that the candidature may be going awry if candidates are physically absent from the university for more than a couple of days or a week at the most.

Turning to the Senior Lecturer working in the Natural Sciences in a G8 university, aside from academic designation another difference between this supervisor and more senior counterparts relates to a practice that is unique across the total interview data set. This supervisor personally introduces new PhD candidates to all staff and PhD candidates within the research team and related organisational elements, and to university staff associated with candidates' research (i.e. research office staff, librarians etc. …) This supervisor's account of these induction activities was corroborated by interviews conducted with three present PhD candidates.

Ten interviews were conducted with present or former PhD candidates of High-range Natural Sciences supervisors. Interviews were also conducted with three present candidates of the High-range supervisor who identified as working in 'Other' disciplines. The data collected from these 13 candidates corroborate the substance of their supervisors' interviews.

High-rangeHigh-range Social Sciences supervisors

A key difference between the two High-range Social Sciences supervisors and their Natural Sciences counterparts is that they do not routinely employ postdoctoral staff as de facto supervisors. Nor do they fully integrate all of their candidates within a team of researchers

working on a research agenda within their research elements. This is because most of their candidates are part-time enrolments.

One supervisor runs informal coursework sessions and organises candidates into cohorts where possible. Like High-range Natural Sciences supervisors this supervisor prefers not to take on candidates unless their research interests are methodologically or substantially consistent with the supervisor's research agenda. This habit enables the supervisor to consolidate personal effort in supervising large numbers of candidates successfully.

The second Social Sciences supervisor has at times developed informal supervisory teams. The supervisor is also active within a national network of professionally associated researchers and integrates some candidates into this network via its annual postgraduate conference.

Both supervisors consistently win external research income. However, unlike Natural Sciences supervisors they do not consistently draw on it to fund PhD candidatures.

High mid-range supervisors (n = 26)

Supervisors classified in the High mid-range completed around three candidates every two years on average during the eight years period 1990–97. They reported either completion rates of 100 per cent involving between 10 and 15 completions, or, provisional completion rates of between 77 per cent and 93 per cent involving 11 or more completions.

The interview sample for this range included:

- 17 Go8 and 9 non-Go8 supervisors
- 19 Natural Sciences supervisors, one Social Sciences supervisor, one Humanities & Arts supervisor and five supervisors from 'Other' disciplines.

The profile of High mid-range supervisors displays the following characteristics:

- All co-author conference and journal papers with their candidates, but this practice is ubiquitous among supervisors working in the Natural Sciences and Other disciplines while it is sporadic among the supervisors working in the Social Sciences and the Humanities & Arts.
- All have won ARC grants or funding from other sources. Like their High-range counterparts, High mid-range supervisors working in the Natural Sciences and Other disciplines regularly utilise such income to fund PhD candidatures. Supervisors in the Social Sciences and the Humanities & Arts do so occasionally.
- Twenty-five supervise more full-time candidates than part-time candidates and prefer to do so. One supervises an equal number of full- and part-time candidates.
- Twenty-five are male, one is a female working in the Social Sciences in a G8 university.
- Twenty-three began supervising PhD candidates prior to 1992.
- Eleven are Professors (eight work in Go8 universities, three in non-Go8 universities and all are male).
- Eight are Associate Professors (four each work in non-Go8 and Go8 universities and one is female).

- Four are Senior Lecturers (all work in Go8 universities and are male).
- Two are Senior Research Fellows (these two supervisors identified their designation in the survey as Other. Both work in Go8 universities and both are male).

Like their High-range counterparts, these supervisors developed their supervisory knowledge and skills informally, on-the-job. They have worked in universities for between 15 and 35 years. Their ages vary from late 30s to early 60s. Most are in their mid- to late 40s.

High mid-range supervisors in the Natural Sciences and 'Other' disciplines

The 19 supervisors working in the Natural Sciences include seven Professors, six Associate Professors, four Senior Lecturers and two Senior Research Fellows. A majority of the latter three designations lead research groups. The remainder, like High-range supervisors, supervises across larger research teams comprised of two or more groups working on broader research agenda.

The activities of these supervisors closely resemble those of High-range supervisors. They conduct research collaboratively and employ team-based supervisory practices. Time and productivity are given high priority in the supervision of candidates. They work closely with candidates and postdoctoral staff on the development of candidature deadlines, milestones and routine candidature progression.

However, these supervisors are more willing than High-range supervisors to take on candidates who do not have a scholarship. They still supervise full-time candidates almost exclusively, but spend more time with them in the laboratory or in the field than do High-range supervisors. They see their candidates more frequently in research team meetings and on a formal individual basis than do High-range supervisors. They turn text around in a one-day to one-week timeframe, often overnight. They begin to suspect that a candidature may be going astray if the candidate is physically absent from the university for more than a day or a couple of days at most, rather than a week.

These comparatively minor differences between High and High mid-range Natural Sciences supervisors seem to be a function of the different stages of their careers and the different priorities attendant on their work. High-range supervisors are mostly Professors and tend to be less involved in the micro-management of research teams and candidates. A majority of High mid-range supervisors is Associate Professors, Senior Lecturers and Senior Research Fellows and is closely engaged in micro-management.

This is especially the case for High mid-range supervisors who do not employ post-doctoral staff. Senior Lecturers working in non- and G8 universities are included here. So too are an Associate Professor pioneering a totally self-funding spin-off from a non-Go8 university, and a Professor located within a Humanities organisational unit in a Go8 university who identifies as a Natural Scientist. This supervisor's research agenda integrates studies of natural and social phenomena.

The five supervisors who identified themselves as working in Other disciplines present a profile that is similar to the last Natural Sciences supervisor mentioned above. Their supervision methods are similar to those of High-range Natural Sciences supervisors. They involve candidates in collaborative research and supervision, they co-author with them, they put a premium on timely completion and develop networks with industry. However, in

contrast with Natural Sciences supervisors who work within a discipline or discipline area. Their and their candidates' research is trans-disciplinary.

High mid-rangeHigh mid-range Humanities & Arts supervisors

The supervisor working in the Humanities & Arts in a non-Go8 university operates similarly to Natural Sciences supervisors. Candidates are integrated into research agenda. However, the agenda are of a lesser scale and candidates are integrated loosely in comparison with the Natural Sciences. Like Natural Sciences counterparts, this supervisor works collaboratively with government and other researchers, but does not employ postdoctoral staff. Consequently, individually, this supervisor is more burdened at the day-to-day level of supervisory activity than supervisors in the Natural Sciences.

Some international candidates are supervised and interviews with a present and a former international candidate corroborate the substance of this supervisor's interview data. Both spoke highly of the benefits of being involved in collaborative research. However, the present candidate spoke at length of the difference in their circumstances and those of other international candidates with whom this candidate is familiar. In particular, the candidate drew contrasts between the lack of editorial assistance received by them in comparison with that received by the candidate. This candidate praised the supervisor's habit of making regular substantial written comments on text and arranging face-to-face meetings to discuss them.

High mid-rangeHigh mid-range Social Sciences supervisors

This supervisor's candidates must purchase raw data for their theses and the supervisor's research or consultancy earnings are not used to assist in these expenses. However, due to the high cost factor of their research and industry interest in it, the supervisor inculcates a professional approach to research in candidates. The supervisor encourages candidates to publish during candidature and strongly advises them to try and publish only in reputable, high impact outlets. The supervisor is likewise adamant that candidates present conference papers at key professional gatherings only. The supervisor assists candidates to sharpen their journal papers and conference presentations, based on the belief that research must be presented in a compelling way that in effect sells the research. This supervisor gives all candidates the same message: *'there is no point in doing research unless it is published'.*

Middle mid-range supervisors (n=26)

Supervisors classified in the Middle mid-range completed around one candidate per year on average over the 1990–97 period. They reported completion rates of 100 per cent with between seven and 10 completions, or, completion rates of between 77 per cent and 91 per cent involving completions of between seven and 11. Survey data and corroborating categorical interview data indicate similarities but also significant differences between the profile of this group of supervisors and the profiles of High and High Mid-Range supervisors.

The interview sample for this range included:

- 15 Go8 and 11 non-Go8 supervisors
- 18 Natural Sciences supervisors, four Social Sciences supervisors, three Humanities & Arts supervisor and one supervisor from 'Other' disciplines.

The profile of Middle mid-range supervisors is as follows:

- Supervisors in the Natural Sciences and 'Other' disciplines supervise largely full-time candidates, in comparison with Social Sciences and Humanities & Arts supervisors who supervise more part-time candidates.
- Twenty-two are male, four are female. Three of these females work in the Natural Sciences while the fourth works in the Humanities & Arts.
- Twenty-two regularly co-author journal papers with their candidates (all in the Natural Sciences). However, only seven regularly co-author conference papers with candidates (four from the Natural Sciences and one each from the Social Sciences, the Humanities & Arts and Other disciplines).
- Fourteen began supervising PhD candidates during or after 1992, 12 began prior to 1992.
- Ten experience regular success in attracting external research income from the ARC and other sources (nine from the Natural Sciences and one from the Social Sciences).
- Ten are experiencing limited and sporadic success in this sort of endeavour (four from the Natural Sciences, three from the Humanities & Arts, two from the Social Sciences and the Senior Research Fellow).
- Six have experienced little or no success in winning external research income (five from the Natural Sciences and one from the Social Sciences).
- Eleven are Senior Lecturers (10 males, eight of whom work in the Natural Sciences, plus a female who also works in the Natural Sciences). Seven work in non-Go8 universities, four in Go8 universities.
- Nine are Associate Professors (eight males, five of whom work in the Natural Sciences plus a female who also works in the Natural Sciences). Five work in non-Go8 universities and four in Go8 universities.
- Three are Professors (two are males working in the Natural and Social Sciences respectively while the third is a female working in the Humanities & Arts). Two work in non-Go8 universities, the third in a Go8 university.
- Two are Lecturers (both are males working in non-Go8 universities in the Natural Sciences and the Humanities & Arts respectively).
- The Senior Research Fellow is a female working in the Natural Sciences in a Go8 university.

Like the higher range supervisors already discussed, these supervisors learned their supervisory knowledge and skills informally but their careers are comparatively less developed on the whole ranging from eight to 30 years' experience in universities. Their ages range from mid-30s to mid-60s. Most are in their early to late 40s.

Middle mid-range supervisors in the Natural Sciences and 'Other' disciplines

Of the 18 supervisors working in the Natural Sciences, nine each work in non-Go8 and Go8 universities. Fifteen are male, three are female.

The six with the shortest careers could be called young up-and-comers (three are female and four are aged under 40). They are developing their own research agendas in collaboration with other academics within and outside their universities and with industry partners. They

are highly focused on growing their research income in order to expand their research capacity. Like High mid-range supervisors these supervisors' research agendas are associated with teams, but they do not employ post-doctoral staff in their localised research groups. Like High mid-range supervisors they organise their candidates into cohorts where possible, but their cohorts are smaller. Consequently, their supervisory practice displays very high levels of interactivity with candidates. Much is at stake for these supervisors and career advancement is inextricably intertwined with their candidates' success. At present, they are experiencing considerable success. The situation is similar for three of the more experienced supervisors in this Natural Sciences group.

The situation of the other nine supervisors in this group is quite different. Four of these supervisors have worked in universities for at least 10 years but have experienced significant reductions and in one case a total loss of external research income. Their research activity and thus their supervisory capacity have diminished.

This is also the case for the supervisor working in 'Other' disciplines. This supervisor works in a freelance way, sporadically attracting external research income and financing candidates on a project-specific basis.

The remaining five supervisors have been unable to attract research income of any substance and are struggling on their accounts. In the views of all five, in the Natural Sciences it is difficult for them to attract candidates without their own research income and without candidates it is difficult to conduct substantial research. Because these supervisors are cash strapped, some of their candidates spend considerable energy in writing grant applications in order to fund their PhD research.

Middle mid-range supervisors in the Social Sciences

The group of four Social Sciences supervisors comprises a Professor, an Associate Professor and two Senior Lecturers. All four work in non-Go8 universities. Two are aged in their 50s and two are in their 60s.

The latter two supervisors supervise candidates whose research interests are loosely aligned with their own research agenda. Where possible, they prefer to supervise full-time and ideally scholarship holding candidates. However, both take on candidates who do not fit this description. These include significant numbers of full-fee-paying international candidates who on both supervisors' accounts are welcome enrolments with their respective universities, but are very high maintenance in terms of supervision. Neither of these supervisors employs postdoctoral staff and neither has been able to sustain cohorts of candidates. Nor have they consistently attracted substantial research income for the purpose of funding candidatures.

The former two supervisors present a similar profile to the other pair except that they have a lesser record for attracting research income. They also take on mostly non-scholarship candidates with an array of research interests outside their own principal areas of research activity. A significant minority of these candidates (both full- and part-time) is externally enrolled and with them face-to-face supervision is rare. It is the norm for both supervisors to go for a month or more with no email or telephone contact from them. Both regret initiating contact less often than they would like to. Both have comparatively large numbers of candidates (six or seven) working in disparate areas under supervision at any one time. Both report the absence of what they would call a 'collaborative' research culture within their organisational units and indeed across their faculties. They would prefer that this was not the

case and while they have attempted at various times to encourage the consolidation of research activity within their organisational elements, their attempts have met with little success. Indeed on one supervisor's account, '*the net result of my efforts at developing a research concentration was a long and protracted legal battle that pitted factions of supervisors and their candidates against each other, divided the faculty for 10 years and led to a number of students terminating their candidatures'*.

Middle mid-range supervisors in the Humanities & Arts

Of the three Humanities & Arts supervisors, two are male (an Associate Professor and a Lecturer), one is female (a Professor). All three work in non-Go8 universities.

The Lecturer is the youngest of the three, with a profile resembling the young up-and-comers working in the Natural Sciences. This supervisor attempts to organise candidates into cohorts and keeps in close contact with them in the early and busy stages of candidature. The supervisor is part of a loosely bound group of colleagues that candidates can consult.

The Associate Professor discharges a university level administrative role in conjunction with supervisory duties and supervises predominantly part-time candidates. Many are external and the supervisor's success rate is notable because of this.

The supervisor attributes success to a habit of establishing a face-to-face relationship at the outset of the candidature. In the supervisor's view, the practice cements the relationship between supervisor and candidate so that it can endure the privations and misunderstandings characteristic of supervision at a distance. The relationship begins with an informal contract that establishes the roles, responsibilities and expectations of supervisor and candidate. The candidate then goes into external mode with flexible deadlines and milestones in place and an initial brief to develop a working thesis outline as the research topic is developed. This outline forms the substance of the next communications and as the candidature progresses chapters are filled in.

The Professor discharges middle management duties additional to supervisory activities. This supervisor works on a satellite campus of a non-Go8 university that is comparatively new and was brought in to establish a research culture. There are few active researchers in the supervisor's organisational element. The pool of potential candidates available is mostly comprised of either working mothers or mid-career professional women who in the supervisor's view are unfamiliar with universities and research and lack self-confidence in comparison with the few males the supervisor has supervised. The supervisor has won research income and has attempted to develop cohorts of candidates, but this approach has been ad hoc at best. The supervisor experiences difficulty in getting research published. The supervisor would like to publish with candidates and encourages other supervisors in the organisational element to do so, but this has not eventuated.

Low mid-range supervisors (n = 20)

Low mid-range refers to supervisors who reported provisional completion rates of between 24 and 67 per cent, with the number of candidates supervised ranging from 15 to 26. The age range is from mid-30s to late 50s. Most of the supervisors are in their late 40s or early 50s.

The interview sample for this range included:

- 12 Go8 and 8 non-Go8 supervisors

- six Natural Sciences supervisors, eight Social Sciences supervisors, five Humanities & Arts supervisors and one supervisor from 'Other' disciplines.

This range's profile is as follows:

- Thirteen are male, seven are female.
- Thirteen supervise more full- than part-time candidates.
- The seven supervisors who supervise mostly part-time candidates report provisional completion rates of less than 50 per cent.
- Six are Senior Lecturers (four males and two females with three working in each of non-Go8 and Go8 universities).
- One is a male Lecturer working in the Humanities & Arts in a non-Go8 university.
- One is a Senior Research Fellow working in the Natural Sciences in a Go8 university.
- Four are Professors (all males working in Go8 universities, three in the Social Sciences and one in the Natural Sciences).
- Eight are Associate Professors (five females and three males, working in four each of Go8 and non-Go8 universities). Four work in the Natural Sciences, two in the Social Sciences and one each in the Humanities & Arts and Other disciplines.

Low mid-range supervisors in the Natural Sciences

The six Low mid-range Natural Sciences supervisors reported provisional completion rates of between 50 per cent and 67 per cent. All bar one supervise twice as many full- as part-time candidates, but none leads an established research team or employs postdoctoral staff.

Two of these supervisors are attempting to reach what they consider a 'critical mass' (between 10 and 15 people including academic staff, ideally a postdoctoral staff member and 8 to 12 PhD, Masters and Honours candidates). However, one of them is faced with the prospect of doing so on a satellite campus with a student base comprised of mostly international candidates who the supervisor believes have little intention of remaining beyond their candidatures. The other is expecting to improve performance when relieved of current Head of School duties.

Of the remainder, one is a Senior Research Fellow whose salary is paid by a number of organisational units but the supervisor alone must attract all funding necessary for the conduct and supervision of research. The second works in an 'unattractive', specialised sub-field that augments more popular fields. The third is in a similar position. In addition, candidates are already highly trained and well-paid career practitioners pursuing areas of personal interest. All three have supervised PhD candidates for at least nine years, but publish sporadically with them.

The sixth supervisor could be called a critic of Natural Sciences supervisory tradition for at least two reasons. This supervisor takes on only candidates who are doing research that is not directly related to the supervisor's. The supervisor's belief is that the Natural Scientific ritual of supervising candidates whose research interests closely coincides with their supervisor's is open to abuse. Some supervisors *'use it as a way of getting candidates to do their research for them'*.

In addition, this supervisor will not publish with candidates, because to the supervisor's way of thinking this practice borders on 'parasitism'. The supervisor therefore refuses on ethical grounds to be involved with it. The supervisor is aware that because of this ethical stance candidates often experience difficulties that candidates undertaking conventional candidatures in the Natural Sciences do not. However, the supervisor's view is that the candidates that complete are better quality researchers because they are highly independent and have a flair for originality.

Low mid-range supervisors in the Social Sciences

The eight Social Sciences supervisors reported provisional completions ranging from 24 per cent to 63 per cent. The four that supervise an equal number of full- and part-time candidates reported 50 per cent or better completion rates. The four who reported completion rates below 50 per cent supervise between twice and seven times as many part-time compared to full-time candidates, with significant numbers of external enrolments.

Of the four supervisors who reported better than 50 per cent completions, none belong to what they would call a 'collaborative' research culture. One operates on a satellite campus of a non-Go8 university that is building a research culture, with mixed success. The second reports that many candidates abandoned their candidatures in a Go8 university for lucrative careers during the latter half of the 1990s. This supervisor is in a re-building phase. The third and fourth are networked with other researchers in their areas of research activity, but report that many of their candidates are full-time employed women either working in industry or in universities. They believe that supervising academic staff creates an added burden for them and these candidates. On the one hand, the candidate experiences work pressures in addition to the normal stresses related to undertaking a PhD. On the other hand, the supervisor experiences added stress because these candidates already are academic staff and they therefore relate differently to their supervisors in comparison with candidates who are not academic staff. Political tensions attend these candidatures, ranging from differences of opinion between supervisor and candidate regarding the quality of the candidate's work, to intra-department/school/faculty pressures to complete. It can be the case that the job or promotion of candidates who already are academics is contingent on completion.

The four supervisors who reported completion rates of less than 50 per cent are an Associate Professor and two Professors who work in Go8 universities, and a Senior Lecturer working in a non-Go8 university. Only one of them has supervised candidates for more than 10 years. This Professor reports that over more than 20 years it has been practice to encourage candidates who are not highly independent or well organised to seek out another supervisor. In this supervisor's view it is not incumbent on supervisors to think for candidates, copy-edit or *'hold their hands'*. Thus, while the supervisor insists on the production of text in advance of meetings only substantive verbal comments are communicated to the candidate at meetings. If a candidate fails to produce text, misses two scheduled meetings consecutively, or turns up unprepared, the supervisor takes this to indicate a pattern of procrastination or disorganisation. Three missed or unprepared meetings confirm the pattern. At this point the supervisor advises candidates to either change their behaviour or find another supervisor. Some candidates choose the latter option.

The second Low mid-range supervisor takes on candidates whose areas of interest are loosely related to the supervisor's, but a majority is part-time, externally enrolled, fully employed in their mid- to late-careers. The supervisor sees them around eight or 10 times a year and

expects they will complete in a timely manner because they are highly competent, mature professionals.

The third supervisor's candidates are all female. This supervisor is just starting to fund PhD candidatures out of research winnings and is attempting to develop a research seminar series around common areas of interest. The supervisor reports that seminars are well attended by candidates but not by staff, which the supervisor finds *'frustrating'*.

The fourth works in comparative isolation supervising large numbers of external part-time candidates. These candidates are either career professionals or academics already employed in other universities. The supervisor regrets that in the past up to a year sometimes went by between communications. The supervisor was alerted to the perils of such infrequent communication when a candidate sent what the candidate believed to be a complete thesis draft. The supervisor found this draft indecipherable and had some difficulty convincing the candidate, who was an academic working in another university, to rework the thesis. The supervisor now tries to maintain email contact with external candidates on a monthly basis.

Low mid-range supervisors in the Humanities & Arts

Four of the five Low mid-range Humanities & Arts supervisors work in Go8 universities. One is an Associate Professor who supervises mostly female candidates. According to this supervisor there is a documented phenomenon of female candidates suffering a sort of '*culture shock'* in the university research environment, because it is alien in their experience. This can be coupled to *'self-disbelief'* on being accepted into a PhD candidature, which may heighten to such an extent as completion nears that these women believe themselves to be frauds and unworthy of receiving PhDs. They then sabotage their own success by not completing their candidatures.

A second of these supervisors is a Senior Lecturer working in a Go8 university who attributes their candidates' lower completion rates and slower completion times to the high cost and seasonal influences of the type of research undertaken. Candidates often end up in protracted negotiations in order to gain entry to the remote places where they conventionally conduct fieldwork. They then spend periods of up to a year in the field. This is expensive monetarily and in terms of time; three years can easily elapse before data analysis begins.

The other three Low mid-range supervisors' experience is of supervising relatively large numbers of candidates who have very disparate research interests and orientations. None of these supervisors works within what they would call a 'collaborative' research culture and they do not co-author with their candidates. One of has won external research income but did not use it to fund candidatures. However, this supervisor is contemplating doing so because a number of potential candidates have approached and asked to take up a set project within the funded area. This supervisor is also thinking about taking up the option of publishing with candidates.

All three are attempting to consolidate their and their colleagues' research efforts and to better align candidates' research interests with theirs. On their accounts these efforts are yet to materialise into something more concrete.

Low mid-range supervisors in 'Other' disciplines

The Associate Professor who identified as supervising in 'Other' disciplines supervises mainly part-time, externally enrolled full-fee-paying international candidates with an array of research interests. Supervision is juggled with Head of School duties in a Humanities organisational element.

Further analysis of interview data suggests that the key similarities, differences and anomalies between supervisors can be classified into five discipline-specific categories. These categories are discussed substantively in the second chapter of the report, with additional detail including data extracts appearing below in Appendixes 4—6. A sixth more generic category dealing with the pedagogy of PhD supervision is also evinced by the interview data. It is discussed in the third chapter of the report and in Appendix 3.4.

For purposes of readability, it is suggested that the reader read the chapters of the report and the appendices supporting them concurrently.

Appendix 3.1: A more attainable credential

The association between tacit discipline-specific expectations about the scope and range of PhD research and different disciplinary completions and submission times manifests in the focus and forms of PhDs.

In this and following appendixes, the following scheme have been used to protect the anonymity of interviewees:

R: = Researcher
(Range)(Discipline)(number) e.g. HRNS3: = Interviewee
--- = Pause
… = deletion of words from interview transcript
[word] = deletion of word or words that might identify the interviewee and insertion of non-identifying words.

The focus of PhDs

For purposes of illustration, the focus of the PhD refers to the content and style of the thesis. Content is meant to refer to the conceptual depth and breadth of the thesis in terms of theory and method. By style is meant the elucidation of the thesis argument. Two data extracts are compared and contrasted below to illustrate the extent to which tacit discipline-specific expectations about the focus of PhDs can differ. The different consequences in terms of timely completion of candidatures that ensue are illustrated by supervisors' respective completions data.

The first extract of data is taken from an interview with a High-range supervisor working in the Natural Sciences. This supervisor works in a Go8 university, routinely co-authors with candidates, has over thirty years experience supervising PhD candidates and is well networked within other universities and industry. The supervisor is associated with a research team working across a number of research groups substantially funded via external research income. Candidates are full-time and internally enrolled, many of them scholarship holders. Survey data indicate that over the 1990–97 period 19 candidates (17 full-time, two part-time) were supervised with a 100 per cent completion rate. When this supervisor was asked *'what is a PhD?'* the supervisor replied:

> **HRNS7:** A PhD can be in any discipline area but basically it cuts at the fundamental content of the discipline and the nature and validity of the ideas … In every discipline part of the philosophy is based on what we call axioms, those are supposedly truths---the next level is that in putting those supposed truths together you can come up with an integrated truth which is called a theorem. And at that stage you're starting to deal with the development of hypotheses that are raised out of pre-existing knowledge. Some people wish to look at those ideas in an alternative way and that I call a corollary … And then the final step in the development of knowledge, I guess, is to be able to apply those theorems and corollaries in such a way that you solve problems. So a doctorate of philosophy is first of all an approach to the knowledge base that allows you to identify a problem. And, quite frankly, the problem may have its roots in something that is inaccurate about an axiom, something that is wrong in the logic of putting axioms together to produce a theorem, or a corollary that is in fact skip logic and it inverts the information but incorrectly does it.
>
> ***R:*** *And in your field if somebody develops a PhD that says, 'I've attempted a new way of doing something which is justifiable but it didn't prove anything', that's still acceptable?*

> **HRNS7**: Absolutely. Absolutely. As long as their logic is not flawed or if it was flawed they identify the flaw to stop other people from going down that track.

This data extract is quite specific about the content and style of a PhD thesis. Content is depicted in the second, third and fourth sentences in terms of theory by the words *'axioms, theorems, hypotheses or corollaries'*. The fifth sentence depicts content in terms of method, which means *'to be able to apply these theorems and corollaries in such a way that you solve problems.'* The seventh sentence also refers to content, but in a way that illustrates style by showing how the interaction of theory and method can be used to develop an argument that detects *'something that is inaccurate about an axiom, something that is wrong in the logic of putting axioms together to produce a theorem or a corollary that is in fact skip logic and it inverts the information but incorrectly does it.'*

The supervisor's first and last sentences additionally illustrate style by emphasising that a PhD 'cuts at the fundamental content of the discipline and the nature and validity of the ideas' (first sentence) and is acceptable 'As long as their logic is not flawed or if it was flawed they identify the flaw to stop other people from going down that track' (last sentence). In effect, the extract illustrates that the content and style of the PhDs supervised adhere to a research convention of using logic in order to confirm or disconfirm extant knowledge and thereby add to its existing stock.

In addition, the first sentence of the extract states that 'A PhD can be in any discipline area but basically it cuts at the fundamental content of the discipline and the nature and validity of the ideas.' This datum implies a relatively confined scope and range, because the thesis is conducted 'within a discipline area' and is applied out to the discipline. The PhD's contribution to knowledge is accretive; it is not of the order of a paradigm shift. Aggregate interview data indicate that this is typical of Natural Sciences PhDs.

Interpreting these data as criteria of content and style for producing an acceptable thesis, they imply that undertaking a PhD in the Natural Sciences is a relatively formulaic if not simple exercise. What is required and how it is to be done are quite explicit and reasonably well defined.

Explicit discussion and explanation of these thesis requirements with candidates is a central tenet underlying the supervisory practice of this and many High, High-Mid and Middle mid-range supervisors, across disciplines. This deliberate explanatory approach can be interpreted as emphasising the substance of the PhD and in pedagogic terms it is relatively interventionist or 'hands on'.

By way of comparison the second extract of data below is taken from an interview with a Low mid-range supervisor working in the Social Sciences in a non-Go8 university. This supervisor only recently started co-authoring with a few candidates, has 10 years experience supervising PhDs and has won research income sporadically but not for the purpose of funding PhD candidatures. Most of the supervisor's candidates enrol part-time, many externally. These external candidates are widely dispersed around the country and some of them are academics employed in other universities. Survey data indicate that over the period 1990–97 a total of 26 candidates (nine full-time and 17 part-time) was supervised with a provisional completion rate of 24 per cent (four full-time and two part-time). When this supervisor was asked 'what is a PhD?', in contrast with the Natural Sciences supervisor this supervisor talked about the PhD and the candidate in a conjoined way:

> **LMRSS4:** Mostly they're pretty enthusiastic people and the sorts of PhDs that I supervise are people who want to change the world. I mean they don't just want to protect the world or report on the world and describe it---they want to transform it. So they get involved in transformative endeavours and so part of that is proselytising---you know---they want to tell the world how to be a better place … It's a matter of becoming---learning the language of the discourse community that you're seeking entry into … So I mean from a personal perspective the doctoral study is like any other piece of research. It's a discursive performance---but I reckon what they're learning first and foremost is something about themselves. The thesis is really about the person who writes it and it's about anybody else that they study because they have to learn so many things not the least of which is learning how to write in a particular genre or genres because there are many possible genres. But you still have that within the overall 'ballpark' of an academic---sort of performance. So learning a discursive art form is a large part of what it's all about. I mean in my field writing itself is not just the old reporting on reality in a descriptive sense, it's an interpretative act. And for many of my candidates it's also an intentionally transformative act. It expresses different intentionalities and different realities I suppose.

In this data extract it is difficult to discern what is content. For example, in the second half of the sixth sentence the supervisor states *'The thesis is really about the person who writes it and it's about anybody else that they study because they have to learn so many things not the least of which is learning how to write in a particular genre or genres because there are many possible genres'*. The first portion of this piece of data implies that the candidate and those they study are the content of the thesis, but, this is tied to the style of writing in one of many possible genres. Similarly, the last sentence of the extract states: *'It expresses different intentionalities and different realities'*. From this datum it could be inferred that the thesis content is also different intentionalities and different realities. These two data samples suggest that the research design of such a PhD would be a more complex undertaking than is conventional in the Natural Sciences.

Similarly, the extract suggests that the style of this PhD is ambitious. This is evidenced by the latter half of the third sentence that states: *'part of that is proselytising—you know—they want to tell the world how to be a better place'*. Nor is style a straightforward matter, because *'writing itself is not just the old reporting on reality in a descriptive sense, it's an interpretative act'*. Style also has to be learned, because *'it's a matter of becoming—learning the language of the discourse community that you're seeking entry into …* [and] *… learning a discursive art form is a large part of what it's all about'*. These data suggest that producing a PhD of this sort necessitates a level of stylistic sophistication not conventionally expected in the Natural Sciences.

Further, in the total data extract style and content are virtually inseparable from the person undertaking the candidature. The first, second and third sentences of the extract state that *'mostly they're pretty enthusiastic people and the sort of PhDs that I supervise are people who want to change the world ... I mean they don't just want to protect the world or report on the world and describe it—they want to transform it. So they get involved in transformative endeavours'.* These data imply that undertaking the sorts of PhDs that this supervisor supervises is the province of exceptionally committed, idealistic and active candidates who take on tasks that exceed what is customarily expected of candidates in the Natural Sciences. In terms of scope and range the data suggest that PhDs of this sort have almost no limit**s**.

Interpreted as criteria for producing an acceptable PhD thesis, when these data are combined with those illustrating content and style they imply that in addition to producing a complex and highly sophisticated thesis candidates must further demonstrate their own uniqueness as

well as their achievements. Crucially, in contrast with the Natural Sciences rendition of what is the substance of a PhD, in this extract the focus of the thesis is on the candidate's individuality and the originality.

It is important to recognise that this illustration indicates how vast disciplinary differences can be. Other data comparisons indicate a tendency for some Social Sciences and Humanities & Arts supervisors toward adopting an approach more like that of their Natural Scientific counterparts which emphasises substance, with better results in terms of timely completions. The following extract of data is one example.

The data extract is taken from an interview with a Middle mid-range supervisor working in the Humanities & Arts. Supervising candidates undertaking disparate and unrelated PhDs is this supervisor's experience. The supervisor works in a non-Go8 university and has less than 10 years' experience supervising PhD candidates but more than 20 years' academic experience. The supervisor is a Senior Lecturer, is somewhat networked and has won one grant that was not used to fund a PhD candidature. Candidates are predominantly part-time. Survey data indicate that during the period 1990–97 a total of eight PhD candidates (three full-time and five part-time) was supervised with a completion rate of 87.5 per cent.

Late in the interview this supervisor was reflecting on a history of supervising PhD candidates in an area of the Humanities & Arts. The researcher asked a question asked of all interviewees when winding up the interview, namely, *'is there anything about PhD supervision that we haven't covered that you think is important?'* The supervisor replied:

> **MMRH&A3** I have a little hobby horse I'd like to get on here --- The PhD is not the quest for the grail --- and I think that we have done generations of candidates a disservice by allowing it to be such. And I think that we need to not only cultivate an atmosphere but to construct practices which present potential candidates with much more clearly defined set pieces.
>
> ***R****: Something approximating coursework?*
>
> **MMRH&A3** Yes. Yes. I also think we need to be able to say, 'You are a cohort of candidates. Here is an offering of possibilities and it's a limited offering and we're asking you to take up one of these and here is a range of supervisors with whom you can work on one of these. Treat it not as the meaning of your life but as an apprenticeship in research.

In this extract of data the first sentence in the supervisor's first turn above implies that in the supervisor's view Humanities & Arts PhDs have been wrongly defined (*The PhD is not the quest for the grail*), and, consequently, candidates have been disadvantaged (*and I think that we have done generations of candidates a disservice by allowing it to be such).* The implication is that the scope and range of Humanities & Arts PhDs are unnecessarily ambitious.

In addition, this supervisor suggests *'that we need to not only cultivate an atmosphere but to construct practices which present potential candidates with much more clearly defined set pieces'*. This piece of data suggests that the scope and range of Humanities & Arts PhDs can be scaled back as well as predetermined to a greater extent than is currently the case as the supervisor sees it. The supervisor further suggests that candidates be advised to '*treat it not as the meaning of your life but as an apprenticeship in research'*. The focus here switches from individuality and originality to substance, and when this shift of focus is considered alongside the supervisor's comment that candidates be told *'you are a cohort of candidates'*, the implication is that in the supervisor's view candidates in the Humanities & Arts need to

be imbued with an explicit sense of collaboration rather than implicitly viewing the exercise as a solely individualistic endeavour.

In referring to 'cohorts' the supervisor points to another key disciplinary difference between the way PhD supervision occurs in the Natural Sciences on the one hand and elsewhere on the other. In the Natural Sciences candidates are implicitly conceived of and explicitly supervised as cohorts. This formula is rare outside the Natural Sciences, as the second chapter of the report and the next appendix shortly show.

Moreover, this supervisor's affirmative response to the researcher's query about coursework points to a discernible informal trend in some areas of the Social Sciences and the Humanities & Arts of using coursework in PhDs already. This trend is also discussed in the second chapter of the report and the next appendix.

For present purposes, the foregoing data comparisons are pertinent for drawing attention to the tacit disciplinary differences between the images of the persons who emerge from the PhD exercise as credentialed graduates. Irrespective of supervisory range, in the Natural Sciences the image of the credentialed graduate is that of a 'trained research scientist' working collaboratively with other scientists in comparatively confined areas of research interest. In contrast, in the Social Sciences and the Humanities & Arts the image of the credentialed graduate tends to be that of a 'solo virtuoso', although Middle HighMid- and High-range Social Sciences and Humanities & Arts supervisors data indicate that there is some synergy in these disciplines with the image of the trained research scientist.

The different forms of PhDs undertaken within disciplines evince further disciplinary contrasts that influence the likelihood of timely completion.

The forms of PhDs

For purposes of illustration the form of the PhD refers to the finished item that is submitted for examination. There are three main forms[10] that PhDs conventionally take:

- a monograph
- a monograph including published papers
- a bound set of published papers.

The monograph

The monograph is an extended written exposition of a research problem or issue. It is the prevailing form of PhD submitted in the Social Sciences and the Humanities & Arts. Social Sciences and Humanities & Arts supervisors across all ranges see great value in the monograph's function of representing a sustained coherent argument and an in-depth exposition of that argument which engages with a problem or issue. The monograph contains:

- a full and complex account of the research problem or issue
- research approach(es) that is/are detailed, sophisticated and justified

[10] A fourth form of PhD is the exegesis or performance increasingly undertaken in the Arts. No comment is made on the exegesis here, because none of the supervisors interviewed for the study were associated with its use. This circumstance is probably due to the comparative newness of Arts PhDs being presented in this form. The parameters of the study no doubt excluded it from consideration.

- a continuous argument
- varying degrees of novelty and substance
- in some areas of the Social Sciences and the Humanities & Arts, explicit accounts of the researcher's own values and beliefs.

The cultural preference of Social Sciences and Humanities & Arts supervisors for this form of PhD is consistent with survey data highlighting the cultural trend of publishing books in these disciplines. Candidate and supervisor interview data further indicate that candidates in these disciplines mostly do not publish papers during the course of the candidature, indicating a transfer of the preference into PhD candidatures. Indeed interview data suggest that attempts to publish during candidature are often seen by Social Science and Humanities & Arts supervisors as onerous for the candidate and distracting from the primary goal of generating the monograph.

The cultural preference for monographs is consistent with survey and interview data indicating that candidates in these disciplines do not publish to any great extent with their supervisors. Joint publication violates the originality criterion so valued in the PhD within these disciplines.

In contrast, interview and survey data corroborate that candidates in the Natural Sciences routinely publish during their candidatures and frequently do so with their supervisors. These contrary publications customs of the Natural Sciences on the one hand and the Social Sciences and the Humanities & Arts on the other provide an underlying explanation of why a variation on the monograph form of PhD thesis is mostly undertaken in the Natural Sciences, namely, the monograph including published papers.

The monograph including published papers

Some universities will allow only the submission of monographs. However, an admissible variation on the monograph is to include a list of papers published during the course of the candidature, and frequently the actual papers themselves.

Including or listing published papers in the monograph is consistent with a cultural expectation expressed by Natural Sciences supervisors that candidates should publish refereed journal papers during the course of their candidature. This expectation echoes survey data highlighting both the Natural Scientific custom of co-authorship and the tradition of co-authorship between supervisor and candidate.

Moreover, most supervisors who encourage the submission of this form of thesis suggest that the published papers increase the likelihood of smooth passage through examination. The papers have already been refereed and published and this announces the quality of the thesis to them. Only one Natural Sciences supervisor expressed a dissenting view about the quality of theses containing already refereed articles.

A reported problem with this form of PhD is that it takes time away from candidature and the production of the monograph. Alternatively, some High, High- and Middle mid-range Natural Sciences supervisors per se question the worth of monographs. These supervisors argue monographs of either form are an inefficient way of presenting and disseminating research findings. The further argue:

- monographs are unlikely to be read by more than six people, namely, the candidate, their two supervisors and the three examiners
- chapters must be rewritten for publication
- monographs lack portability
- monographs are unsuitable for publication as a book.

In these supervisors' views such problems are overcome by the bound set of research papers,[11] which in effect does away with the monograph.

The bound set

In non-Go8 and Go8 universities that accept it as a legitimate form of PhD, the bound set includes the following:

- an introduction that contextualises the research to which the papers refer
- the papers, which are sometimes linked via the insertion of cohesive ties between them
- a concluding discussion revolving around the papers.

Among High-range supervisors from the Social Sciences there was some support for this form of PhD, but it was hardly discussed by Social Sciences and Humanities & Arts supervisors in general and appears to be rarely used in these disciplines. In contrast, High, High-Mid and Middle mid-range supervisors in the Natural Sciences report either support for the idea, or that their candidates already submit PhDs of this form. For these supervisors, the value of the bound set is seen to reside in its:

- efficiency, because no rewriting of monograph chapters is required
- training value, because writing papers for publication in refereed journals is seen as integral to a future career in research
- extrinsic worth, because it adds value to:
    - the candidate's employment prospects
    - the supervisor's publications track-record
    - the reputation of the candidate's research element
    - the university's research quantum
- relationship to a tacit scientific dictum that research is worthless unless it is published and disseminated
- quality, because the standard of refereeing involved in gaining acceptance for publication (especially in international journals) is believed to be higher than the standard usually applied to the examination of PhD monographs. Between eight and 12 examiners may be involved as well, because each paper is refereed.

Conversely, problems with this form of PhD that some supervisors allude to include:

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[11] The Bound Set of Research Papers is different to another form of PhD rarely discussed by any informants but called a PhD by Publication. The PhD by publication involves the collation of research previously undertaken into a volume of work.

- An absence of quality in terms of explanatory and justificatory depth, because journal papers conventionally do not include detailed expositions of theory and method or their justification.
- The time lag between submission of a paper for publication and its eventual publication. Presuming the paper is actually published, it is common for two years or more to elapse between submission and publication of journal papers.
- Variable quality between research journals and consequent problems of consistency associated with comparability of theses.
- The mix of submitted and/or accepted and/or published and/or total number of papers.
- Joint-authorship, because joint authored papers do not strictly conform with the originality criterion against which PhDs are judged.

Appendix 3.2: More collaborative research support

There can be no doubt that in the broader sense of critical mass meaning research infrastructure, resources and finance, there are disparities between universities and disciplines. However, for purposes of discussion concentrations of researchers that support PhD candidatures are the focus here.

Research support of PhD candidates begins at the localised small-scale level of research collaboration. The organisational unit at this level is the cohort, ever present in the data of Natural Sciences supervisors and candidates but largely missing elsewhere. Cohorts integrate PhD candidates into research groups and teams pursuing broader research agenda. The process of integration is underpinned by collaborations between supervisors working across a number of different research elements within universities.

Depending on how well networked the supervisor is, at a broader level candidates additionally gain entrée to other universities, government and industry players. High and High mid-range supervisor data suggest that this level of networking occurs across disciplines. However, broad-scale networking that involves PhD candidates was found among High-range Natural and Social Sciences supervisors, High mid-range Natural Sciences supervisors and a few Middle mid-range Natural Sciences supervisors.

The influence of these levels of research support on candidatures is now illustrated by data comparisons between supervisors of different ranges. The discussion starts with cohorts of PhD candidates.

Cohorts

In the Natural Sciences, PhD candidates are regarded as individuals at various stages of progression who in turn comprise cohorts at the level of a research team or group's broader operations. In larger research concentrations with established and enduring research agendas like those involving High and High mid-range Natural Sciences supervisors in non-Go8 and Go8 universities, cohorts are common. Cohorts of candidates are integrated into the research concentration's historical past, present and future. The extract of data below is illustrative.

The extract is taken from an interview with a High mid-range Natural Sciences supervisor working in a Go8 university team situation involving supervision across research groups. The supervisor attracts research income from the ARC and industry and uses some of it to fund PhD candidates. The supervisor publishes prolifically with candidates, almost all of whom are full-time and internally enrolled. A majority is scholarship holders. While the supervisor funds some candidates' scholarships or research expenses from money earned consulting to industry, the logic in doing so is not entirely altruistic. The supervisor believes that reinvesting monies that could be taken as private income is better policy for developing research agenda in the longer term than immediate personal gain. Survey data indicate that over the 1990–97 period 17 candidates (14 full-time and three part-time) were supervised with an 82 per cent completion rate.

The data are extracted from a point in the interview where the supervisor had been discussing the benefits of supervising candidates working on similar PhD projects. The supervisor had

used the word 'cohort' a number of times in the discussion, which prompted the researcher to ask, *'what do you mean by a cohort?*' The supervisor replied:

> **HMRNS11:** A cohort I tend to think of as people who arrive at the same time, but cohorts may go through time over a 10-year period. So we may end up with a dozen people doing PhD's on … [an animal] … They're sort of like a lineage family tree, sort of research programme development. That's very good, because students then have a lot of framework. They've got a postdoc to talk to. They've got two---automatic two or three supervisors. They've got PhD students before them and after them, so they're buffered on all sides in time and there's lots of ways they can communicate.

In this extract of data, a cohort involves '*people who arrive at the same time'* and candidates have '*PhD students before and after them'*. These datum evoke a sense of continuity of research focus among candidates, an impression reinforced by the supervisor's statement that '*cohorts may go through over a 10 year period'*.

This way of integrating candidates as cohorts in turn assists '*research programme development'* in what appears to be a symbiotic or mutually beneficial way. On the one hand, the cohort helps to integrate the candidates into the team structure. This is illustrated by the supervisor's comments about '*a lineage family tree'* that gives candidates '*a lot of framework'* such that they have '*a Postdoc to talk to - automatic two or three supervisors*'. On the other hand, the research programme's life is sustained via the regular infusion of new cohorts of candidates. In making mention of postdoctoral staff this supervisor's data additionally highlight the integral advisory role these staff play in the work-a-day life of the candidate.

In contrast, while cohorts of PhD candidates are not unheard of in the Social Sciences and the Humanities & Arts they seem to be rare. One of the candidates interviewed for this study is now an academic working in the Social Sciences. This candidate contacted the researcher independently and was not a former candidate of any of the interviewed supervisors. However, the candidate commented extensively on experiences as a member of a cohort of candidates who completed their studies via a Graduate School that integrated Social Sciences and Humanities & Arts candidates' research around an organising theoretical theme. The candidate's data reflect an integrating experience similar to the one described above.

In turn, the extract of data below is a direct example of a Social Sciences cohort taken from an interview with a High-range supervisor working in the Social Sciences. This supervisor's history is one of supervising more part- than full-time candidates. Candidates tend to be career professionals of different ranks in their industry workplaces. Survey data indicate that over the 1990–97 period 29 candidates (12 full-time and 17 part-time) were supervised with a completion rate of 83 per cent (10 and 14 full- and part-time completions respectively).

Success in supervising large numbers of candidates the supervisor attributes to aligning the research interests of candidates. This is achieved via informal coursework based on research method that gives cohorts of candidates a focus on substance.

During the interview this supervisor elaborated on international experiences as part of a cohort of PhD candidates functioning within a large research institution. This led to the researcher asking *'have you, in your supervision, set up a microcosm of that?'* The supervisor replied:

> **HRSS1:** It has happened. I went through periods when I had a lot of graduate students in the mid 90's, where I set up an informal sequence of method seminars for my PhD students. It wasn't compulsory---you know---we'd hold them at four o'clock on a Friday and it would be anything between 10 and 30 people there. Some staff would turn up---it was all related to working with data. It wasn't related to position papers, because here's no shortage of ideas. What there's a shortage of is reliable knowledge that we can draw on! So that's---I think---what they were about. They happened because I kept getting five or six or seven students I'd work with individually. They hadn't any training from anywhere else, so I just thought 'Bugger this. I'll put them all in a mob and we'll start it up and make them work among themselves as well.'

In this extract the cohorts described are informal in their origins and constitution. However, there are two striking parallels between this Social Sciences supervisor's explanation of why they were established, and, the emphasis of Natural Sciences PhDs on the substance of the PhD and the image of the 'trained research scientist'.

In the second line of the extract the supervisor states: *'I set up an informal sequence of method seminars for my PhD students'*. The fourth to seventh lines go on to suggest that one reason for this is *'it was all related to working with data.'* These data emphasise the substance of the PhD by focusing candidates on method. When read in conjunction with the supervisor's comment that *'it wasn't related to position papers, because here's no shortage of ideas. What there's a shortage of is reliable knowledge that we can draw on!*' this inference is reinforced. It is further supported by the supervisor's claim that *'they hadn't any training from anywhere else'*.

In the last half of the last line of the extract the supervisor goes on to say that the intention was to '*make them work among themselves as well*'. This intention coheres with an underlying precept of cohort development in the Natural Sciences, namely, the facilitation of research collaboration among candidates.

Further examples of cohorts and broader collaborative supervisory arrangements are presented in Appendix 3.4, for the purpose of illustrating the teamwork dimension of 'hands on' supervisory pedagogy.

Appendix 3.3: Stakeholder investments in candidates' success

It is undeniable that better funded and resourced candidates have a higher probability of timely completion. However, it is impossible to tell from the data what the overall mix of state and private contributions to this situation are at the level of individual supervisor accounts. Nor is it possible to tell from the data what are the distributive mechanisms and their relative allocations that universities and their organisational elements employ.

In short, every supervisor believes university funding and resources is insufficient in his or her area. Many suspect that someone else is benefiting at their expense. Consequently, combinations of stakeholders involved in PhD candidatures and the effects their investments have on candidates' success in this competitive environment are crucial. Four such combinations are examined. For purposes of discussion the researcher has categorised these combinations as the following types of candidatures:

- industry-based candidatures
- industry-partnered candidatures
- university-based candidatures
- fee-for-service/candidate funded candidatures.

Industry-based candidatures

The label 'industry-based' is meant to denote that the PhD is aimed at solving a problem in industry. It connotes that along with the problem under investigation the funding and resources attached to the candidature come in the main from industry. The supervisors involved with these sorts of PhDs are directly and indirectly associated with CRCs, Research Centres, universities' organisational elements and state and private industry in complex ways.

The data of High and High mid-range Natural Sciences supervisors and supervisors working in 'Other' disciplines indicate that they supervise all four types of candidature, but some draw the bulk of their research income from industry and thus supervise many industry-based candidatures. These supervisors approach industry directly with proposals to solve industrial problems via PhD candidatures. In addition to placing the candidate in a paid relationship to industry, because these sorts of candidatures are aimed at solving an industry-based problem there are at least five senses in which they resemble consultancies. The problem under investigation is practical. The project is largely pre-determined. It is specialised. It is outcome-oriented. It is tightly framed and monitored in terms of project specific milestones and deadlines.

Only High, High- and Middle mid-range supervisors in 'Other' disciplines and the Natural Sciences reported supervising industry-based candidatures in any number. Scholarship candidates are the rule. High and High mid-range Natural Sciences supervisor data indicates that top-up monies are frequently placed on scholarships in order to make them more attractive and one of the candidates interviewed for the study stated that the total scholarship package was slightly over $30 000 per annum net. In this sense candidates undertaking industry-based candidatures are comparatively well financed and seem to be less involved in paid work outside their candidatures than are non-scholarship candidates.

Supervisors of industry-based candidatures point to these circumstances as additionally advantageous because the candidate is in effect gaining a grounding in the commercial realities of research and its conduct that constitutes a form of professional development suited to later employment outside of as well as within universities. Alternatively, supervisors who do not supervise these sorts of candidatures but claim to have knowledge of them are suspicious of their methods and quality. They believe that candidates are used as cheap labour during the process. They believe that the graduate is in fact a highly trained research assistant, not a research scientist.

Industry-partnered candidatures

The label 'industry-partnered' is meant to denote that the candidature is associated with industry and includes a significant component of industry and government money and support. ARC grants as well as other state sponsored research schemes and initiatives are included here. Aggregate interview data suggest that these sorts of candidatures are supervised across disciplines, mostly by supervisors in the High, High- and Middle mid-ranges of the Natural Sciences. In contrast, most supervisors in these ranges in the Social Sciences and the Humanities & Arts reported not having supervised one.

Scholarship candidates are the rule. There is a good deal of pressure involved with these candidatures, because their completion is subject to agreed accountability procedures with stakeholders outside universities. There were comparatively minor differences of opinion on the matter of quality between supervisors who do or do not supervise industry-partnered candidatures. Supervisors were more divided over the fairness of competitive grant schemes per se.

Notably, candidates undertaking industry-based and industry-partnered candidatures tend to present papers at international conferences, visit overseas research institutions and publish papers in academic as well as industrial journals as a matter of routine. While the data are not able to determine the extent to which candidates are funded via universities' consolidated revenues in comparison with monies specifically attached to the candidatures, it is clear that in many cases candidates are expected to either win part of their travel costs via a competitive applications process or are expected to fund some of their expenses themselves.

In addition, many of the High and High mid-range Natural Sciences supervisors associated with these candidatures report that candidates' preparations for conference presentations are closely monitored and involve intensive assistance from them, postdoctoral staff, other academics associated with the candidature and the candidates' peers. There are a number of professional reasons for such intensive preparations.

The candidate is in effect viewed as a representative of the supervisor, his or her team, their research element and ultimately their university. It follows that the supervisor's reputation is at stake, because although the candidate will present the paper as the first author the supervisor is a co-author by dint of their ideational and editorial input. Some of these supervisors thus make very explicit to the candidate that the presentation of papers at international conferences represents both a challenge and an opportunity for the candidate. The following extract of data illustrates these points.

The extract is taken from an interview with a High-range Natural Sciences supervisor who works in a Go8 university and supervises candidates via teamwork. The number of postdoctoral staff this supervisor reportedly employs varies between one and four. The bulk

of external funding comes directly from industry in contrast with the maximum number of ARC grants allowable which is a minor portion of research earnings. Survey data indicate that over the 1990–97 17 full- and seven part-time candidates were supervised with 92 per cent completions.

This supervisor believes that among candidates and academic peers the methods of supervision employed have earned the supervisor a reputation as *'a bit of a slave driver'*. The supervisor claims to have high expectations of candidates. The supervisor illustrated these expectations in relation to the presentation of conference papers. The conversation began with the researcher asking, *'do your students go to conferences?'* The supervisor replied:

> **HRNSS9:** It's not whether they go to conferences; they must go to conferences! It's an obligation. They must attend one or two international conferences and present papers and have visits with laboratories and industries overseas during their candidature and they must present one or two or three a year after the first year---none the first year but after that they'll go to conferences.
>
> ***R:*** *Why?*
>
> **HRNSS9:** For the international exposure. It's absolutely important. They must never see themselves as just being part of the university---they are part of the international, … [type of] … industrial community. They have to learn the skills of networking at as early age as possible. We give them some formal training in that and they have to recognise how absolutely important networking is.
>
> ***R:*** *So how does informal training operate?*
>
> **HRNSS9:** That means to sit the student down and explain these things, you know, 'if you want to get anywhere you have to get to know the right people. More importantly they have to know about you as well. In the first instance when you go out there you represent the university but you also represent me. You also represent this research group so you have to make a damn good job of doing that, because if you mess it up there's a lot which is at stake. But that's your opportunity to establish a reputation for yourself because whether you go into industry, whether you go into research or whatever, it's time that you start building yourself as an entity and meet people who could be of assistance to you---internationally. You have to start making an impression---very important'. And we explain these things to them after the first year. The first year it's more a struggle to find direction and just to get on the way with their research.

The interview data collected from supervisors of industry-based and industry-partnered candidatures indicates that supervisors are not always this blunt with their candidates. However, the points about quality control made above underscore many Natural Sciences supervisors' support for the practice of candidates publishing journal as well as conference papers. That is, the reputations of all concerned are at stake and quality is thus paramount. So too, the induction of candidates into the rigors of peer review is a common refrain. Supervisors of these candidatures therefore dispose their research teams' formal and informal capacities to assist candidates to draft written work and rehearse presentations. The latter can involve dry-run rehearsals in semi-formal research team meetings, in cohort groups and on occasions in front of academic staff.

While some of these techniques are employed on occasion in the two types of candidature discussed below, this is the exception and not the rule. In the cases of the two types of candidature below there is an absence of the sort of concerted pressure to perform exerted on candidates in the above types.

University-based candidatures

The label 'university-based' is meant to denote that the candidature is supported and funded by universities. These seem to comprise the bulk of PhD candidatures and are supervised across disciplines and supervisor ranges. A mix of scholarship and non-scholarship candidates is evident. So too is a blend of full- and part-time enrolments, as well as internal and external mode candidatures.

There is therefore an array of differences between these candidatures and the preceding two types that combined show that the numbers and combinations of stakeholders and their direct financial investments in them are less. This is not to say that other than the university, the supervisor and the candidate, nobody else has any stake in university-based candidatures. It is widely believed among Social Sciences and Humanities & Arts supervisors and candidates that university-based candidatures are important because they are often about matters of public interest.

In addition, as a proportion of any one supervisor's load in the Social Sciences and the Humanities & Arts these candidatures seem to place a heavier burden on the supervisor. They seem to be the only sorts of candidatures supervised by some Middle and most Low mid-range supervisors in these disciplines. Part-time and non-scholarship candidates are common, vastly disparate theses are the rule, and, lower and slower completions result.

Moreover, aggregate interview data suggest that much of universities' research bureaus' efforts are devoted to monitoring the progress of university-based candidatures. It thus seems that university-based candidatures are labour and cost intensive for universities proportional to the completions and their timeliness generated. Similarly, while there can be no doubt that candidates undertaking these types of candidature in part-time or external mode do so for a variety of reasons that reflect their circumstances or choices, such enrolments do not reflect the same level of investment and commitment implied by a full-time candidature and survey and interview completions data reflect this.

Fee-for-Service/candidate-funded candidatures

This label is meant to denote that the candidate or the candidate's employer primarily funds the candidature. International candidates who are full-time employees sponsored by foreign governments are included here. So too are international candidates who are self-funding. Academics are included here as well, but only in the Social Sciences and the Humanities & Arts where it appears to be acceptable practice for academics to be hired prior to undertaking or completing their PhDs. They include full- and part-time enrolments and are undertaken in internal and external modes. The data indicate that supervisors of all ranges supervise these candidatures in varying proportions.

International candidates are under pressure from restrictions on their and their spouses' earning capacities, from their sponsors and, where they are not sponsored, their own personal investments seem the heaviest of any candidate in terms of dollar value relative to exchange rates. Supervisors are cognisant of these influences and interview data indicate that they become more involved with assisting these candidates to draft their work than they are with domestic candidates. The editorial burden on both supervisors and candidates is extraordinary.

Similarly, the situation of candidates who already are academics can be troublesome for them and their supervisors. The candidate is under pressure for employment reasons while the supervisor is under pressure because the candidate is a peer. Relationships can be strained.

In short, the first two types of candidature are better resourced and involve greater investments by more and various stakeholders than the second two. There can be no doubt that this contributes to timelier completion. However, this situation does not furnish a sure fire recipe for success.

In addition to the financial investments of industry and universities, some supervisors invest their own externally earned research income in candidatures. All supervisors in the Natural Sciences claim that they themselves fund some of their candidate's expenses out of their own research or consultancy earnings, or turn prospective candidates away if this is not possible.

This situation puts great strain on individual supervisors and their organisational elements, because the value that PhD candidates add to consolidated research efforts and to individual supervisors' careers is not easily ignored. Natural Sciences candidatures can go awry under these circumstances. The following extract of data is illustrative.

The extract is taken from an interview with a candidate in the Natural Sciences who has 10 years' industry experience in the field researched. The candidate contacted the researcher when the study came to the candidate's notice via the means a university used to invite its supervisors to participate in it. The candidate holds a Scholarship and exhibits many of the qualities that supervisors look for in candidates, qualities such as enthusiasm, perseverance, diligence and intelligence.

The candidate attempted to select a supervisor, but this person did not have the money to fund the project. The candidate has changed supervisors twice thus far. The extract picks up from the point in the interview when the candidate was leading to the discussion of these matters which were then explained as follows:

> **NSC13:** I came to … [where I live now] … with an idea of one … [person] … that I wanted to work with. I'd seen … [this person] … talk at a conference and it was just, 'Yes, this is the … [person]... This is the topic. This is what I want to do.' And I held to that thought for a couple of years while I was working. And then I came and saw … [the person] … who said, 'Look, I'd love to have you as a student but I can't afford to pay for your project'. So that was disappointing. I found some other names and I went to the … [person] … who turned out to be supervisor number one and … [that person] … said, 'Yep, I'll take you on.' But then I was really not getting any supervision at all and I thought, 'Well, Jesus, if I'm going to be ignored by my supervisor I may as well be ignored by a supervisor at a university that's closer to home. Well I changed universities and one of the reasons that led me to look at … [my present university] … was this … [type of] … technique that I'm using. They had the equipment. They had the … [person] … to run the lab. My supervisor number one had said to me off-handedly, 'You should get one of those grants.' So I went and talked to the second … [person] … who runs the lab and they basically said to me, 'Yes, your programme is interesting and this is an ideal application but frankly I don't do grants for anybody. I'm way too busy with my own research.' I said, 'Well, how about if I moved here and became on of your PhD students? Do your PhD students get to do grants?' And it was honestly indecent how … [the person's] … eyes lit up and … [they] … virtually grabbed me by the arm and hustled me into the Head of Department and said, 'This is … [the candidate's name. This candidate] … would like to switch universities and come to our department and do some … [research technique] … .' And the Head of Department said, 'Lovely. Wonderful.' And I said, 'I have no funding. I don't bring any research grant with me. Will you guarantee to fund my project?' And … [the Head of

> Department] … said, ‘Yeah, sure.’ And I said, ‘I work in … [isolated areas] … . It’s very expensive. It’s more expensive than other PhD projects. Are you willing to fund my whole project.’ And … [the Head of Department] … said, ‘Yeah, sure. Absolutely.’ So I came to … [my present] … University and the promised funding never appeared and I found out later that the Head of Department knew … [they were] … leaving and taking my supervisor along with … [them].... And I had essentially no funding. So I’ve been spending, you know, a fair amount of my time doing things on the cheap with volunteers, which is very time-consuming. Writing grant applications, which is very time-consuming and has an incredibly low success rate, or occasionally I take on external contracts. So through a long and complicated series of events now my supervisor is at a different university, interstate. So I now split my time between where I am enrolled and … [another] … university, where the equipment is. Where I was this morning … [the interview was conducted on a Sunday morning]

There is no corroborating evidence in the interview data to suggest that the situation described above is more than isolated. However, it points out associated problems in the commercial and career dimensions of PhD supervision. As incentives for pursuing research income as a means of academic promotion and for attracting PhD candidates increase, individuals and universities can be expected to behave in ways that appear to be more self-serving than mutually beneficial from candidates’ perspectives.

Appendix 3.4: The pedagogy of 'good' PhD supervision

The following indirect example of the use of cohorts illustrates how cohorts can be beneficially applied to Humanities & Arts PhD supervision. It additionally shows how cohorts can be operationalised with some success among externally enrolled part-time candidates. In particular, it shows the centrality of trust and teamwork in the supervisory relationship.

The example is indirect, because it involves an extract of data taken not from a supervisor's interview but from an interview with a former PhD candidate of a supervisor who did not participate in this study. This candidate was included in the study because two supervisors who were included in it contacted the candidate. They believed the candidate would be able to provide rich data about experiences working in what the supervisors believe is a highly successful supervisory arrangement in comparison with their and their faculty's usual procedures. The researcher's contact details were given to the candidate who then contacted the researcher and expressed a desire to contribute an interview.

The supervisory arrangement involves an academic supervising mostly externally enrolled, part-time, female candidates undertaking theoretically similar PhDs. The extract illustrates how the candidate's supervisor consolidated supervisory efforts and developed a collaborative and trusting environment. It picks up from a point in the interview when the researcher was probing the candidate about why the candidate's PhD was undertaken in the way it was.

> ***R:*** *So why did it happen that way? Does your supervisor use only … [this type of] … analysis?*
>
> **H&AC4**: There are many … [of this type of] … ways of looking at issues.
>
> ***R:*** *But … [the supervisor] … wouldn't take on somebody who wanted to do statistics, for example?*
>
> **H&AC4:** No. I can't imagine that. I think both the supervisor and the student have to have a comfortable fit in perspective theoretically.
>
> ***R:*** *Okay. You mentioned before that your supervisor had something like nine students. Does your supervisor run a cohort model?*
>
> **H&AC4**: Yes.
>
> ***R:*** *Can you explain how that works?*
>
> **H&AC4**: Um, because the supervision is trans-continental we eventually set up –
>
> ***R:*** *-Transcontinental? You mean across Australia or across the planet?*
>
> **H&AC4**: International---yeah. I think there were about six in Australia and three international. E mail was just becoming the 'thing' around that time. So very quickly … [the supervisor] … established a post-grad alias and we could chat away about issues---I'm still on the alias. I'm not a student any more but I'm still on the alias as one of … [the supervisor's] … past writers. Many of them do co-written papers as well as discussing their actual study on the boil at the time.

R: *And do all of them use … [this type of analysis] … ?*

H&AC4: Yes.

R: *So aside from email how else does the cohort work?*

H&AC4: Well, some of the partnerships are very strong and personal and I know that some of them write to each other on email independently, but there are things that the whole group finds interesting. So I think for each member it's a different level of interaction at different times and, obviously, some people say, 'Look, sorry I haven't contributed for six months. I've been struggling with Chapter Two.' So it varies. There's no rule about it.

R: *Is there formal face-to-face meetings or anything like that?*

H&AC4: No. Occasionally we get to see each other if there's a confirmation or exit seminar on campus and they travel in and on the whole, I have to say, the original group of about 15 are all still together with the exception of one.

In this extract's initial six lines the interchange between researcher and candidate illustrates that the supervisor and the candidate used a particular type of analytic approach. The candidate then confirms that this same approach was used by contemporaries by responding *'yes*' to the question, '*And do all of them use* … [this type of analysis]*?'* The candidate describes how the supervisor '*established a post-grad alias'* on which the candidate and contemporaries could '*chat away about issues'*. The candidate goes on to say that '*many* … [co-authored] … *papers as well as discussing their actual study on the boil at the time*.'

These pieces of data illustrate how this candidate's cohort communicated their research with each other, and published as well, in a way that is similar to how cohorts communicate and publish in the Natural Sciences. In this case the communication occurs mostly in an electronic environment, but it is collaborative and evokes a teamwork metaphor.

Further, in the extract the candidate emphasises that '*the original group of about 15 are still there with the exception of one*.' This piece of data illustrates longevity of association between cohort members.

Moreover, the impression of belonging to a coherent group of researchers with similar interests is strong, evidenced by the candidate's comments that *'some of the partnerships are very strong and personal'*, and, *'there are things that the whole group finds interesting'*. There is also a clear sense of courtesy and mutual obligation between candidates and supervisor in the comment that cohort members apologise when they *'haven't contributed for six months'*. The use of the word *'contributed'* implies that it was understood between cohort members that in addition to receiving assistance from the cohort they were expected to give something back. Reciprocity seems to be understood in this situation. Importantly, reciprocity is a key ingredient of trust and collaboration.

A further illustration of reciprocity and collaboration in supervision is evidenced by a data extract taken from an interview with **HMRNS11** whose data were used to illustrate the operation of cohorts in the preceding appendix. It is extracted from a later part of the interview when the supervisor was describing how candidates are incorporated into this supervisor's research network. The supervisor was asked, *'But how does this come about?'*. The supervisor replied:

> **HMRNS11:** People who I'm supervising or co-supervising or people nearby who are in a similar field. Like in the … [type of research] … centre there's a dozen or so academics who sort of stick together and so there's cross-linkages there, but it's largely through discussions. We have two discussions a week and we have a whole range of different activities and then everybody on the mailing list---there's about 35 people who are all invited to that and I may be primary supervisor for eight or nine students but they're interlinked to maybe another 20 scientists and then I'm co-supervisor for another five or six students who link me through to another series of groups.

The supervisor's last sentence above illustrates the integrative mechanism of intra-university networks. Candidates are integrated into the functioning of teams via *'series of groups'*. In turn, candidates '*link'* the supervisor to these groups. In effect, the network is a conduit for the reciprocal flow of information between its members.

Reciprocity also underpins collaborative teamwork relationships at a broader level of university partnerships with industry. Such partnerships occur mainly in the Natural Sciences, mostly among High and High mid-range supervisors. The two extracts of data below illustrate how candidates are integrated into networks of this scale.

The extracts are taken from an interview with a High mid-range supervisor working in the Natural Sciences in a non-Go8 university. This supervisor's research agenda is focused on the development of innovations in industry. Like the supervisor in the last extract, this supervisor supervises mostly scholarship candidates. Survey data indicate that eight full- and five part-time candidates (13 in total) were supervised with a completion rate of 85 per cent.

Like many High and High mid-range Natural Sciences supervisors, this supervisor claims to fund some scholarship candidates with external research income earnings. The supervisor is highly focused on growing sources of external research income and it is important that candidates complete their projects in a timely manner because their results form the basis of the grant applications that the supervisor seems to write almost ceaselessly.

The first extract describes the extent of this supervisor's network.

> **HHMRNS6:** So we've done a lot of the [specialised research] … here. We're working and collaborating with somebody at … [a government research institution] … who is actually making the … [animal] … for us because we don't have the expertise. We're also collaborating with somebody down at … [an industrial site] … who is going to do routine … [type of research] … to see what the pathology is in these as well … And we're also collaborating with somebody in … [another state] … who is going to be doing the pathology of the … [animal] … when it comes out. So these are not things that I can do but it's all biological.
>
> **HHMRNS6:** So you have to be able to-----
>
> ***R:*** *----- collaborate with teams around the country?*
>
> **HHMRNS6:** Yes. Yes. It's almost impossible to do research these days in this area without doing this.

This extract points to a network that extends beyond the supervisor's own area of expertise to encompass three other research related organisations. It functions similarly to the intra-university network described in the previous extract, but on a larger scale. Collaboration as the driver is illustrated by this supervisor's comment that *'It's almost impossible to do research these days without doing this'*. The supervisor also says *'we don't have the*

expertise' and '*these are not things that I can do but it's all biological'.* The supervisor's own limitations are frankly discussed in this piece of data, which implies that the supervisor reciprocates and trusts others who know better to get on with their part of the research.

In the extract below the supervisor went on to say how supervision carries candidates into this broader collaborative arrangement:

> ***HHMRNS6:*** I don't try to restrict them by saying, 'This is our lab. You have to work within this environment and everything has to be done here.' I would say, 'Okay, we have a problem at this point in time. Who around the place can help us work this one through? Just get on a phone and start talking to other people around and maybe we can collaborate or they can give us some assistance.

The supervisor's reference to a *problem* is illustrative of a common situation reported by Natural Sciences supervisors of all ranges. Research in the Natural Sciences always runs into difficulties and candidatures are no exception. However, this supervisor's description shows that candidates are neither left alone nor reliant solely on their supervisor's nous when problems arise. Rather, the supervisor expects that someone '*around the place can help us work this one through'*, and that the appropriate course of action is to *'start talking to other people and maybe we can collaborate or they can give us some assistance'*.

Overall, the foregoing data highlight the inter-relationship of trust, reciprocity, collaboration and team-work in PhD supervision. They highlight key preconditions that enable 'hands on' pedagogy to function.

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Glossary

2A: Second Class Honours Division A

ARC: Australian Research Council

CRC: Cooperative research centre

DDOGS: Deans and Directors of Graduate Studies

DEST: Department of Education, Science and Training

DETYA: Department of Education, Training and Youth Affairs

Go8: Australia's eight 'research intensive' universities

H&A: Humanities & Arts

HMR: High mid-range

HR: High-range

LMR: Low mid-range

MMR: Middle mid-range

NBEET: National Board of Employment, Education and Training

NS: Natural sciences

RHD: Research higher degree

RTS: Research Training Scheme

SPSS: Historically, SPSS stood for Statistical Package for the Social Sciences. Now, however, it doesn't stand for anything. It is simply the name of both the programme, and the company which produces it.

SS: Social sciences