Research degree supervision: 'more mentor than master'

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Introduction

One can say a lot about research degree supervision, and indeed whole books have been written about it. The aspects touched on here are issues of pragmatic concern in my dual roles as a dean of graduate studies and professor of applied mathematics in a relatively new university—University of Technology, Sydney (UTS). While my own background is scientific, what strikes me most in my pan-university role are the similarities of the problems across fields of study rather than the differences.

A widespread problem is "inadequate supervision; a lack of communication between supervisor and student; the student's misperception of standards, requirements, and of the supervisor's role and functions" (Zuber-Skerritt, 1992). One has to assume that there is some institutional and individual commitment to trying to solve such problems where they exist. Thus if there is no workload recognition for the supervisory role, then it may not be done well or it may be avoided except by the very dedicated. I have therefore decided to concentrate mainly on some practical aspects of alleviating the problem, though I recognise there may not seem to be agreement: courses for supervisors, the mentoring aspect of supervision, and various institutional structures, including graduate schools, and, even more fundamentally, what a research degree is and what it is for.

The synonyms for 'supervision' in Roget's Thesaurus range from 'director' and 'manager' to 'agitator' and 'demagogue'. A moment's reflection on our supervisory activities and those of our colleagues may make us feel that this is as close to an adequate definition as we can get. This is because there is a danger in trying to formalise the role of supervisor and the relationship with the candidate that we might destroy that intangible quality which makes for good supervision. Like 'intelligence', we think we know it when we see it even if we cannot define it. It is intangible because, even for the same supervisor, it varies, not only from topic to topic, but even more importantly with each student one guides. It is this interpersonal relationship, which can be so fragile, with its imbalance of institutional power and intellectual authority in its embryonic stages, and which defies 'how to do it' kits. Yet safety nets, of varying strength, are needed particularly in newer universities and emerging fields of study where the pool of experienced supervisors is limited and changing supervisor in midstream may not be feasible.

Without guidelines and a framework for operation, however, candidates can be at the whim of academic idiosyncrasies. Furthermore, we now work in an era of position descriptions, performance indicators, work plans and strategic plans.

Obviously not all active researchers make good supervisors, though they may be more likely to attract good students. On the other hand, it would be very rare for a person inactive in research to be even a barely adequate supervisor in mathematics and sciences. "How can a faculty that is not abreast of recent trends offer the best educational experience to the interested student?" (Merrill, 1992). The people and the personalities, the project and its purpose, can disguise the dynamics of the research degree candidature.

Research

This brings us to the inter-dependent questions about the nature of research and the scope of the research degree, particularly the doctorate.

As for a definition of research:

[R]esearch involves critical and creative activities undertaken on a systematic basis, according to rigorous disciplinary conventions and methods of enquiry, to increase the stock of human knowledge. Such extension of knowledge may arise either directly by new discoveries, or otherwise through the development of innovative ideas, theoretical refinements or constructive critiques and syntheses which extend existing knowledge and/or new applications (Fell, 1992).

The view of research in a given field is intimately related to its place in a research degree.

For example, research in mathematics is inextricably linked with the solution of a problem or the application of a technique so that research methodology courses are meaningless. Research in the experimental sciences is usually a team process, so that estimating the contributions of individual members can be problematic. Research in the social sciences is often fashioned by paradigms with seemingly shifting boundaries.

Research degree expectations are also shaped differently across disciplines, from the apprentice model of the sciences through the collegial style of mathematics to the view in some of the social sciences of the PhD as a mid-career peak achieved after many years of isolated labour (an approach not favoured by 'bean counters', incidentally, who want bodies in and out in three years!).

Generally, the PhD rules talk about contributions to the field which are 'original' and 'substantial'. Does this only mean immersing the neophyte researcher into the culture of a field through depth in a narrow sub-field or by acquiring knowledge of research issues and techniques across a number of related subjects which are then applied and integrated in a dissertation? From reading reports of examiners of research degrees from all nine faculties of UTS, I believe there is more than a little confusion among supervisors, candidates and examiners.

During 1992, *Academe*, the Bulletin of the American Association of University Professors, carried several articles and many letters addressed to the question of what is a PhD. The controversy was sparked by the claim that the North American PhD was too research-oriented to be the best or the most relevant way to prepare graduate students for a career of teaching undergraduates.

Those who supported the PhD as a preparation for teaching in higher education argued, with less logic than they hopefully used in their PhD theses, that they learnt a lot about undergraduate teaching from their part time work during candidacy, and that if they made mistakes these were compensated by their enthusiasm and energy.

At the other extreme were those such as Pulling (1992) who argued for that distinctively US innovation: the Doctor of Arts. It was initiated in the early 1970s to develop the skills of those who wanted to teach at the undergraduate level. Practical experience, pedagogy and a project or dissertation which linked a discipline with teaching were its ingredients. It is currently offered in about 30 institutions but suffers from that 'equal but different' label which invariably seems to flounder.

Likewise, the questioning of the commercial value and intellectual worth of doctoral degrees in Australia has given rise to professional doctorates, which often aim to bring the candidate to the cutting edge of research on a broad range of issues rather than focus on a single problem. As these develop further in the next few years, we may well see a re-defining of the role of a research degree.

Towards a mentor model

As Moses (1985) writes:

Studies of supervisors have shown that the ambiguity inherent in postgraduate studies worries many supervisors, because they are unsure of their role. From the role of teacher in the early undergraduate days, where the staff member clearly was the expert and the student the learner, the balance shifts during the years of undergraduate and postgraduate study, until the relationship is more symmetrical and the staff member is more mentor than master.

Not that there is general agreement about mentoring as a facet of supervision, and still fewer agree about what mentoring involves. Yet it is clear that some supervisors attract candidates because they are skilled researchers who adopt a mentoring role.

If good supervision is not easy to pigeon-hole, then how much more difficult is that aspect of it which goes under the name of 'mentoring'. There are two types of mentoring involved in research degree supervision: the more obvious one between supervisors and students, but the no less important one between experienced supervisors and those academics who wish to acquire the appropriate skills in perhaps a co-supervisory role. This is not to belittle the latter task, but rather to recognise that one becomes a capable supervisor by supervising. "All three of my exemplary profs were 'mentoring' if we mean by mentoring the providing of 'models' of professional behaviour" (Booth, 1994).

Thus, mentoring is a process of socialisation into a sense of the significant issues in a discipline. Yet mentoring is a personal thing, and its success depends as much on the personalities of those involved as it does on the appropriate experience of the mentor. The mentoring process should be a dynamic bilateral interaction between colleagues. The mentor has to stimulate, to goad, to encourage at different stages of the enterprise.

In scientific fields, the mentor relationships are "essential in producing in young scientists a sense for a good question or a key problem, a style of doing research or theorising, a critical stance, and a way of teaching their own future intellectual progeny" (Cole, 1979).

It is through the mentor relationship, then, that elite science—seen as an entity unto itself distinct from everyday or 'normal' science—propagates itself. By this view, a great scientific discovery is the product not of individual genius alone but of a scientific knowledge and technique; indeed, these may be the least of it. In a long chapter in Scientific Elite *devoted to 'Masters and Apprentices', Harriet Zuckerman notes that it wasn't knowledge or skills that apprentices acquired from their masters so much as a 'style of thinking', as one laureate in chemistry told her. It was problem-finding as much as problem-solving. Those future Nobel laureates were being socialised, to use sociology's vocabulary, into a sense of the significant, or important, or right problem* (Kanigel, 1986).

However mentoring is viewed, it transcends the research and has meaning if one accepts the distinct teaching role of research degree supervision. Its *raison d'etre* is captured by Ker's evaluation of John Henry Newman:

...The stress Newman lays on the personal interaction between student and teacher and on the university as an intellectual community is one that should strongly appeal to a culture which speaks so much about the need for both community and the personal element, precisely because of the lack of either in modern industrialised society, which is both atomised and depersonalised. The 'holistic' view that modern medicine, for example, takes of human beings is the same kind of educational theory that the Idea of a University *puts forward: just as the psychological state of the physically sick person may be highly relevant to his or her recovery, quite apart from surgery and drugs, so too, the* Idea *insists, the whole mind needs to be educated through active participation in a community of intellectual formation, not just the memory through passive attendance on impersonal lectures. Such a content for learning is so vital for Newman that he is prepared if necessary to abandon the basic formalities of academic instruction in favour of an association,*

however informal, of actual individual minds personally interacting (Ker, 1990).

To the mentoring role, many academics add the responsibility of helping those candidates who want such help onto the next step of their careers, be it a post-doctoral fellowship, an academic appointment or any other career. This is no easy role, and moreover, it's one which some academics eschew on the basis that it's not their job to interfere in such a way. Clearly, to be successful in this phase of the apprenticeship the supervisor needs to be an effective networker (Gaffney, 1995). A formal scheme to assist in this is currently being trialed in the USA by the Association of American Colleges and the Council of Graduate Schools (Harding, 1995). Help with career establishment or development is an extension of a concern by the mentor for a nurturing of 'ownership', both intellectual and emotional, of the intellectual property, and the attendant issues of publishing. This is a complex and currently messy area, with attendant claims on copyright from universities and publishers which do nothing to reassure the novice researcher who is trying to come to terms with institutional and disciplinary variations in conventions about numbers of co-authors and the order in which their names appear. The mere mention of these issues is a reminder of how complex mentoring is in practice because not even the rules of the game are static, let alone those of DEET or one's own university. (On a lighter note, a fifteen author letter in *The New England Journal of Medicine* drew attention to the profileration of authors in science by citing a sixteen author article in the same journal! (Benish et al, 1985).)

Mentoring contexts

The mentoring which took place in the German universities reformed by von Humboldt integrated advanced teaching and research.

*In the famous nineteenth-century laboratories and seminars of German universities that developed from the 1830s onwards, a close integration of research, teaching and study became operationally defined... a heavily idealised three-sided nexus was formed in which the three fundamental activities of research, teaching and study were extensively blended. On a good day in the German laboratory of old, you could not tell one from another! The world of the research-dominated university had found its operational base in a mentor-apprentice, teacher-student relationship founded on linked engagement in research activity (*Clark, 1994).

The mentor can encourage others to tap into this international network by corresponding with researchers. Initially, this can be done by writing for offprints or commenting about publications. Most authors welcome any interest shown in their work, and some will then become 'academic pen-pals', so to speak, something made easier with ready access to electronic mail.

Given the large number of relatively new universities in Australia and the fairly large number of emerging fields, Balint et al (1994) offer a very useful case study of mentoring in an amalgamated institution. The context is broader than that of research degree supervision but still germane to the current discussion, because the profiles of the age distributions of research degree candidates are often bimodal: one part with a median age of about twenty-five and the other part with a median age of about forty. These two groups, of comparable size at UTS, bring very different expectations and experiences to the supervisor-student relationship. The younger might accept Schrodinger's advice, but the older almost certainly would not: "I am very busy, and so many research students want to come and study with me, and they ask for advice what to do. I'll tell you what I say to these students! First year do nothing but mathematics, second year nothing but mathematics, in the third year you can come and talk with me" (Moore, 1994).

Nowhere are these differences more noticeable than in the issue of writing. Habits have to be abandoned or reshaped to the conventions of the discipline, a task which varies with age and background. We have to ask and keep asking: what is this thesis/chapter/paragraph/sentence all about? But how do we help them? Are their difficulties in articulating their ideas due to lack of knowledge or ways of experienc-

ing that knowledge, or to alienating structures in the language? Keller (1992) goes further by pointing out that

until we can articulate an adequate response to the question of how 'nature' interacts with 'culture' in the production of scientific knowledge, until we find an adequate way of integrating the impact of multiple social and political forces, psychological predispositions, experimental constraints and cognitive demands on the growth of science, working scientists will continue to find their more traditional mind-sets not only more comfortable, but far more adequate.

Does this mean that I am ill at ease in my other life of mathematics? No, far from it, but I do believe that if we see ourselves as mentors when we supervise research degree students, then we need to recognise the forces of current fashion and the limitations they may impose on long term career development, themes well crystallised recently by Moyal (1995). As for language, I am the least equipped to deal with it, as I often feel like Alice in talking to Humpty Dumpty! (Carroll, 1960).

Courses for supervisors

Can mentoring be taught? I suspect not, though doubtless one can learn from shared good practice as well as knowledge about the various forms it might take. In so far as one accepts mentoring as part of supervision, it is just one part.

A variety of procedures are emerging in many Australian universities to guide the supervisory process in general. One of these is the development of codes of practice based on AVCC guidelines. These typically address such issues as the background of the supervisors, frequency of meetings between supervisors and candidates, responsibilities of the institution, the principal and co-supervisors and the candidates, rights and duties of candidates, and appeal mechanisms. The fleshing out of such bare bones is very much a function of local conditions and traditions.

A thorny issue is recognition of supervision as part of the work load of an academic, and then giving credit for it when teaching duties are allocated. Supervision clearly involves research, but I would claim that it also involves teaching: teaching of a special sort. Like other teaching, it is sometimes approached in the same way the supervisor was supervised (or diametrically opposed to it, depending on the experience). Like other teaching, one can learn to be a better supervisor from 'best practice' and from awareness of the pitfalls. Among the latter in mathematics and the sciences can be confusing the role of research student with research assistant, or the assumption that because one sees the students every day in the laboratory they are therefore being 'supervised'.

The management of supervision and the management of supervisors themselves are separate processes which have administrative and pedagogical sides. How does one know if supervision is effective on a week to week basis? What are the different forms of co-supervision, and what makes some seem to work better than others, and under what conditions? How can students complain about poor supervision?

Some universities run residential and other courses for research degree supervisors. These typically involve facilitators from a number of disciplines and sometimes other universities so that there is a range of inputs and sometimes conflicting perspectives, which leads to healthy debate. The issues discussed include time management, the writing process, and dealing with the difficulties which occur at the different stages of candidature. Workshops, problem solving sessions, group work and mini-lectures provide variety to the format as participants become more aware of the range of issues. There is always the feeling of 'preaching to the converted', however, or at least to those who are already sensitive to the issues.

Not unexpectedly, the most fruitful periods are often those informal opportunities for networking across disciplinary boundaries in a relaxed but generally stimulating environment. As well as cross fertilising ideas and sharing problems, a very important output can also be cross-faculty supervision of projects. Some universities have also developed induction programs for research degree candidates. Some of these are intensive two or three day affairs; others are highly structured semester-long courses; others still are series of short courses.

University criteria for maintaining some form of 'registration' as a supervisor often include attendance at such workshops every few years, along with such issues as current research activities and output as well as a record of successful research degree supervision.

To some supervisors these procedures may seem to be trying to do it all by numbers, but arguments in their favour relate to the large numbers of new candidates each year in some universities, with many from other universities. They enable candidates to know about their rights, the resources available to them, planning of their programs, and by meeting other postgraduate students they can have that critical mass needed to achieve genuine peer support even if they are not all from the one field of study. Induction programs for new staff also usually feature at least one session which deals with postgraduate issues. Staff who are new to university work often need considerable on-going guidance to balance their variety of duties and the range of expectations—both their own and those of others.

Supervision: contexts and issues

These are some of many issues of university-wide concern which require interaction and co-operation. Quite a few universities have appointed Deans/Directors of Graduate Studies with pan-university responsibility for quality assurance of graduate education, especially research degrees. These can provide a vision for graduate education through (i) policy development, (ii) acting as a catalyst for new programs (increasingly off-campus and even offshore), and (iii) unifying postgraduate student activities. To be seen to add value, they need to act in partnership with other units within a university.

While each Faculty claims to be different, there are many common elements. This is nowhere more obvious than in thesis examiners' reports: time and time again, the same points are made across all disciplines about what is, after all, the final product. Examiners look for clarity in aims, coherence in approach, critical depth, perspective and originality. They are annoyed by poor spelling, language which obscures, literature reviews which are mere descriptive lists, unsubstantiated claims, and unwarranted or unrecognised assumptions. That said, though, one feels at times that one needs to examine the examiner if one is not to make a mockery of mentoring! The research degree examination process in Australia generally needs a thorough re-examination! It would not itself pass if submitted for examination...

Other issues include increased retention and progression rates, decreased completion times, strategies to maintain quality of supervision, provision of infrastructure support, as well as welfare and equity issues. The last named reminds me that many staff and some students react negatively to the élitism and gender bias which they claim is implicit in the concept of mentoring. To the extent that the phenomenon of mentoring exists, one might argue that one should improve the process (Speizer, 1981) and widen the access (Krain, 1983) to capitalise on its positive features. The mentoring suggested here is labelled as 'grooming-mentoring' by some in contrast to 'network-mentoring'. The latter "is characterised by a series of contacts between two or more people in which each plays the role of mentor and protegé at different times and to different times and to different degrees" (Haring-Hidore, 1987). There is also 'peer-mentoring' which can overcome, to some extent, the traditions of a discipline or an institution.

Gender inequities go further: timelines and deadlines may not cater for the commitments of women with children: mentoring may introduce a measure of flexibility. In some areas, too, women have assembled knowledge "in unorthodox ways, outside the university system, but its intrinsic value cannot be denigrated" (Parry, 1995). The PhD by publication may be a partial solution here, though it also requires some supervision if it is to have parity of esteem with traditional PhDs.

To close on this note is to finish with a whimper. It would be nice, for a mathematician to conclude with a solution, though often, as here, all we can do is enunciate a different problem.

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