Inducting our PhD students: Changing the research culture and improving the student experience

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Abstract

Transforming the ways we induct our research students into the Faculty of Engineering at UNSW is leading to a change in the research culture for both staff and students. The Faculty wanted to move away from the practice of assuming that undertaking a PhD is an individual endeavour where students already have sufficient skills to manage and complete their research. The research induction program aims to develop a culture of multidisciplinary teamwork and reflective practice, that offers support in a timely manner and develops skills essential for research management. Drawing on the diversity and internationalisation of our students and staff, our approach applies the concepts of double-loop learning and reflective practice in a program that exemplifies the changes that happen as students move from being a follower or apprentice to being the leader or master of their research. Participants (both staff and students) are often surprised to find common ground despite their different education, work and cultural backgrounds and the variety of research projects. Immediate feedback shows that the majority of the students value the program and report increased confidence in adjusting to their new learning environment. The program is receiving increasing support from students, supervisors, postgraduate coordinators and Heads of School.

Background and context

Once upon a time, or so we are told, completing a PhD was a luxuriously individual endeavour in which developing researchers could languidly absorb a vast array of literature, divine a new avenue for their own ideas, confront their own incompetence, discover their own genius and eventually produce a magnificent tome distilling the wisdom they collected along the way. No more. Now research students and supervisors alike are under pressure from a variety of directions including the Australian Federal Government, who are providing incentives for improved completion times[1], and legal requirements that students be informed of their rights and responsibilities. Even the students themselves are no longer satisfied to drift along in an unsupported environment hoping to acquire sufficient skills to learn to manage their research program. Rather, they are demanding a 'fuller' experience together with assistance and advice on development of skills to effectively manage their research[2, 3].

In response to this, the Faculty of Engineering at UNSW has been establishing a research development program, a major component of which is an induction program that all new students are expected to complete. The program aims to foster a learning environment based

on multidisciplinary teamwork and reflective practice. Each stage of the program endeavours to offer support and encourage acquisition of essential research management skills appropriate to the needs of students during various phases of their research. An important aspect of the induction program is the requirement for all students to prepare and make oral and written presentations.

Currently, we have some 650 students spread across five major research themes in 10 schools and some 22 research centres completing both qualitative and quantitative research projects. Many of the research centres and activities in the Faculty are multidisciplinary, drawing on research expertise and equipment from across different schools, not only within the Faculty and the University, but also from other Universities and research organizations in Australia and internationally. Thus, for many of our students, the multidisciplinary environment of the induction program is a vital mirror of and training ground for their research environment. However, even research students working in isolated environments are likely to benefit and draw support from the sense of community[4] that is built by interaction with and informal mentoring from[5] other research students in the multidisciplinary groups and contexts.

The necessity of developing and adopting good management skills and practices to ensure proper and appropriate progress of the research[3] probably comes as no surprise, especially to Engineering students. The importance of reflective practice[5, 6, 7] is less immediately obvious. For some students, while the focus on technical expertise may be more acceptable as a legitimate form of professional knowing, reflection–in-action and reflection-on-action may not be valued as a form of reflective enquiry or understood as a valuable part of professional knowledge-in-practice[8].

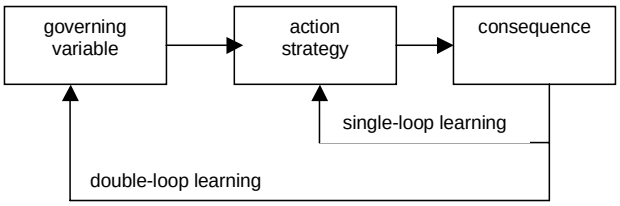

Figure 1. Double-loop learning (adapted from [9])

Schon's concepts[8] of professional knowledge-in–practice and double-loop learning (see figure 1) are well suited for developing research management and communication skills. While supervisors and the school or faculty are best placed to monitor and encourage their own research students' development from apprentice to master, there are advantages in involving expert support services such as the Physical Sciences Library and The Learning Centre at UNSW. It allows further opportunities for reflection both 'in and on' research and communication practices and enhances skills development. In addition, important theoretical background is provided in the context of the needs of research students.

Including scholarly writing and presentations skills at the beginning of the PhD program aims to identify and reduce problems that arise when these skills are not addressed until the student is writing up the thesis, a circumstance where skills are developed 'too little, too late'[10]. Scholarly writing and presentations are complex tasks and are best developed when opportunities for reflection, practice and feedback are provided[11]. Similarly, the inclusion of advanced information literacy by specialist librarians provides not only tools and practice in sophisticated search techniques, but also provides opportunities for reflection on concepts related to the re-definition of topic areas and development of appropriate search strategies.

This paper describes and reflects on the development and outcomes of our research induction program over the last two and a half years. In so doing, it canvasses the challenges and achievements that might be anticipated for such a program and assesses the alignment of these expectations with actual outcomes to date.

Description of the program

The induction program was developed following reading of the literature and extensive consultation with students and academic staff of the Faculty and support staff from a number of units across the University including the Learning Centre, Staff Development, the Physical Sciences Library and the Learning and Teaching Unit. Our approach to the development and implementation of the structured induction program[1, 4, 11, 12] combines the concepts of experiential learning[13] with double-loop learning[14] and reflective practice[6, 7]. It has been argued that due to the dynamic nature of the 'modern state'[8], these approaches provide the key to facilitating change and learning and for improving problem solving skills. So our induction program models the changes that happen as students move from being a follower or apprentice to being the leader or master of their research across all methodological approaches in the Faculty. Its objectives are to:

- Introduce the students to the postgraduate research environment in the engineering disciplines;
- Develop an understanding of the scholarly environment of research;
- Clarify and align the expectations of the faculty, schools, and supervisors for the students;
- Inform students of faculty requirements, policies and procedures;
- Encourage development of skills essential to research including reflective and critical thinking, and, project and time management;
- Reduce student isolation and fear of change and growth; and,
- Create a multidisciplinary collegial environment for future networking.

As shown in table 1, the induction program is a partnership between the Faculty of Engineering, the Learning Centre, the Physical Sciences Library and the Risk Management Unit at the University of New South Wales. The Faculty, through the Associate Dean for Research Training, is responsible for the overall implementation, review and continuous improvement of the program with all units and students actively participating in this process.

Table 1. Outline of the induction program

No	*Component*	*Requirement*	*Responsibility*
1	What is a postgraduate research degree?(Week 2)	Required	Engineering + Learning Centre
2	How do I get started on my research? (Week 5)	Required	Engineering
3	Introduction to Occupational Health and Safety for research students (Weeks 2-14)	Required	Risk Management Unit
4	Information Literacy for research students (Weeks 3-7)	Required	Physical Sciences Library
5	Presentation skills for research students (Week 9)	Optional	Engineering
6	Introduction to critical analysis and writing for research students (Week 11)	Optional	Learning Centre
7	Research overview presentations (Week 13)	Required	Engineering + Learning Centre

8	Word for large documents (Weeks 10-13)	Optional	Engineering
9	Latex for research publishing (Weeks 10-13)	Optional	Engineering
10	Using Excel for research (Weeks 10-13)	Optional	Engineering
11	Statistics for research (Weeks 2-17)	Optional	Engineering
12	Special program for at risk students	As determined	Learning Centre

Between 150 and 200 research students enrol in the Faculty each year, with approximately two thirds enrolling in first session (semester). Around one third of the students are 'international', many coming from non-English speaking backgrounds, but with a number having received all of their education in English. The other two thirds of the students, classified as 'local', consist of Australian citizens, New Zealand citizens and Australian permanent residents. A number of these students come from non-English speaking backgrounds and have only a few years of education in English. The students enrol in one of the ten schools in the Faculty with five schools annually enrolling more than 20 students and the other five schools enrolling as few as one or two students.

All new students are expected to attend the 'required' components of the induction program shown in table 1; between 50% and 70% of each cohort currently comply. 'Required' components are those deemed essential by the Faculty to both meet our 'duty of care' towards students, but more importantly, to provide students with essential information and skills development to assist them in getting started with their research. 'Optional' components are available to students who self-identify that they require more skills development in a range of areas. Around 20-30% of students choose to attend the optional components.

The components of the program have been tested in a variety of formats with different formats found to be suitable for the different components. All components are available (sometimes multiple times) each session. The remainder of this paper focuses on components 1, 2, 5, 6 and 7 of the program shown in table 1.

Description of Selected Program Components

Early incarnations of components 1 and 2 had students meeting together in large lecture groups of 100 students followed by smaller tutorial group activities. The current preferred format for these components is small workshop groups of up to 50 students. Academic supervisors are also invited to attend parts of the workshops. A number of the activities that are used mirror activities undertaken in supervisor training workshops[15]. Participants meet in interdisciplinary groups to create a learning community that can explore concerns, share experiences and complete tasks around typical scenarios encountered by students in the early stages of their research. These workshops include time for reflection on the activities and tasks undertaken, thus developing and uncovering problem solving and research management strategies applicable to novice researchers.

A vital element of the induction program is the completion of individual writing and speaking tasks in the form of a research overview in component 7. The research overview must include a written summary of the proposed research project and critiques of a number of articles that are ranked for their relevance to the research project. A short oral presentation of the research overview is also required. The tasks are designed to encourage students to read regularly and to reflect on both the readings and their own emerging ideas for the research project. From

the written work and oral presentation, students and their supervisors receive written feedback on the student's abilities and any student requiring additional development of their writing and speaking skills is recommended to complete the follow-up in component 12. Approximately 1-2% of students each year require this additional support.

While many research students are more than comfortable with preparing for the research overview, around 20-30% require further assistance as provided in components 5 and 6 of the program. These components form part of a scaffolded approach to the development of scholarly writing and presentation skills in a non-threatening and constructive environment that continues beyond the induction program. The workshops for components 5 and 6 provide an opportunity for students to clarify the speaking or writing task required for component 7 in terms of its objectives, outcomes, feedback and structure. During these support workshops, students not only prepare for their subsequent presentations, but also come to appreciate the benefits of reading for research early in the doctoral program and are encouraged and assisted to clarify the nature of their research and the scope of their aims and objectives. Students are also encouraged to share and explain their opinions and critiques about oral and written communications, to practice giving and receiving feedback and to reflect on how they can improve their own communications. At this stage of their research, there is an emphasis on students becoming aware of their strengths and weakness and developing strategies for managing and improving writing and speaking.

Research Student Evaluation of the Induction Program

Table 2. Frequency table for components 1 and 2 for each session.

Component/Session	*No of students*	*Likert values (% students responding with this value)*						
		1	*2*	*3*	*4*	*5*	*6*	*7*
Component 1								
S1, 2003	75	1.3	5.3	4.0	16.0	40.0	21.3	12.0
S2, 2003	24	0.0	0.0	8.3	20.8	29.2	29.2	12.5
S1, 2004	43	0.0	9.3	4.7	18.6	41.9	23.3	2.3
S2, 2004	24	0.0	0.0	4.2	4.2	16.7	62.5	12.5
S1, 2005	44	0.0	0.0	2.3	6.8	29.5	50.0	11.4
Component 2								
S1, 2003	20	5.0	10.0	5.0	10.0	40.0	20.0	10.0
S2, 2003	24	0.0	0.0	0.0	16.7	29.2	29.2	25.0
S1, 2004	39	0.0	2.6	5.1	23.1	25.6	41.0	2.6
S2, 2004	26	0.0	3.8	0.0	3.8	42.3	38.5	11.5
S1, 2005	52	0.0	0.0	0.0	15.6	81.3	46.9	18.8

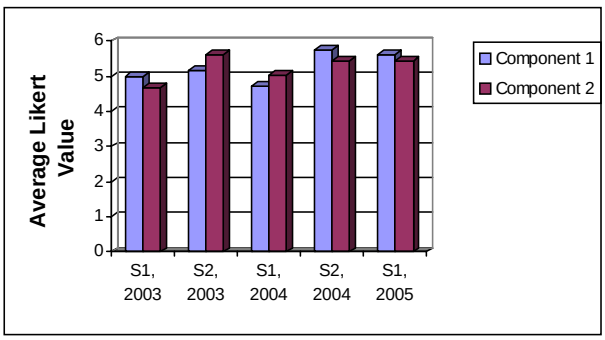

Figure 2. Average Likert values for components 1 and 2 for each session.

Table 2 shows the evaluations that the students gave to components 1 and 2 of the induction program on a seven point Likert scale for each session since the program commenced in 2003. On this scale, 1 was rated as 'terrible' and 7 is rated as 'fantastic'. Figure 2 shows the corresponding average Likert value for each component. From this data, it can be seen that there is a small but important difference

between the student response to their involvement in these components in S1 (session 1), 2003 and S1, 2004 when the program was delivered in large group mode compared to sessions where delivery was via small group mode. In session 1 of 2003 and 2004, more students (as indicated by the predominance of Likert values of 4 or greater and comments listed in table 3) reported satisfaction with the content, interaction with other students and the length of these components but a few students (who gave Likert values of 1, 2 or 3) reported dissatisfaction with the length of the components and the level of participation demanded. This can be

Table 3. Typical student comments about components 1 and 2 for each session.

Session	*Typical Positive Comments*	*Typical Negative Comments*
S1, 2003 large format	• group discussions about writing the project plan and managing the project • it showed my problems are being experienced by others • active participation of all people attending the workshop • learning more about my role and the roles of others involved • workshops • information given	• group discussion weren't useful • some sessions were boring and time consuming • some presenters were giving contrary views • more discussion and hands on experience • longer workshops • less workshops • more about skills development • more writing materials • reduce the length and fluff
S1, 2003 large format	• group discussions about writing the project plan and managing the project • it showed my problems are being experienced by others • active participation of all people attending the workshop • learning more about my role and the roles of others involved • workshops • information given	• group discussion weren't useful • some sessions were boring and time consuming • some presenters were giving contrary views • more discussion and hands on experience • longer workshops • less workshops • more about skills development • more writing materials • reduce the length and fluff
S1, 2004 large format	• workshops – great way to interact with people • small group discussion about milestones and goals • meeting students from different schools • thinking about PhD things not thought of before	• work in smaller groups and run it more often so students can really make use of it • replace group session with something more intensive • shorter • group sessions can be a quick in and out affair • less activities, lots of repetition
S2, 2003 small format	• interaction between people from different schools • know what we are going to encounter throughout the research • know everybody experiences the same thing • learned many issues I hadn't thought of	• less padding in the form of group discussions • more group interaction/activities • more communication with other students • it's perfect already • extend time allocated to presentations • longer time available to group discussions
S2, 2004 small format	• explain what it means to me and what I can expect • insight into myself and assurances that others are in the same boat • hear and learn from others not just from literature • research evaluation based on everyone's points of view	• change the name of the course – induction conjures up images of sitting in a lecture for hours listening to OH&S talks • allow more time for discussions and questions • too much repetition of similar info/ideas
S1, 2005 small format	• I enjoy the interaction and the group work • a lot of info about the bigger picture • meeting other research students and supervisors	• make it shorter • make it longer • more interactive course • perfect enough

	• many good things – better than expected • interactive, relaxed atmosphere • boosting my inspiration • brainstorming about everything	• more slowly so that the international students can understand better • some unstructured segments fell into lulls of inactivity
Long term feedback	• information literacy was most directly useful • the program was a beginning place to jump start my work • panels gave realistic views and useful tips • I would recommend to other students – it offers different benefits to each person	• put more focus on supervisor involvement • make it longer • make it more interactive • get more networking going • can we have more follow-up workshops • don't make us do presentations

contrasted with the small group delivery variations of these components where fewer students reported dissatisfaction with the length and the value of group discussions and interactions was more likely to be appreciated. So it is clear that a crucial constraint for future implementations of the program will be to ensure that each component is delivered to a small enough group of students so that everyone can receive individualised opportunities where their unique concerns and needs are addressed[16].

Facilitator Observations

As with all new programs, it is also clear that many aspects have been implemented well, but other items need attention. Thus, as noted by others[1, 3, 4], it is important to satisfy the persistent need of students for fundamental directions and specific skills for their research, interaction with other students and reassurance that what they are experiencing is 'normal'. As the students work with each other, the facilitators and other students, they come to realise that they often do have strategies that can be adapted to cope with the research environment. They also discover that, despite differences in projects, supervisors and resources, they nevertheless can provide support and guidance to each other[5] and that challenging, changing and transforming ideas and approaches is indeed the essence of research.

Table 4. Transcribed sample output for activity 1 and 2 of induction from S1, 2005.

Activity 1	*Activity 2*
WHAT SHOULD YOU DO? • achieve the 'goal' • comply with regulations e.g. OHS • contribute to academic environment • publish/generate IP • day to day project management • further the reputation • devotion/motivation • feedback/suggestions • life after UNSW	MANAGING MY SUPERVISOR: THINGS I CAN DO • set regular meetings • go prepared to meetings – pre-reading, early results • have good communication – keep supervisor informed of +/-/! • have contact details and know supervisor's schedule • talk to other group members – get to know each other – make friends • be aware of supervisor's management and problem solving style • help supervisor – return the favour • seek supervisor comments/feedback on your progress/plans • know strengths and weaknesses of supervisor and co-supervisor • keep records – problems, solutions, agenda/minutes, lab notes/lab books • build trust with supervisor and colleagues – keep promises, negotiate/talk • have discussion that help clarify problems/directions • get supervisor's experiences to avoid reinventing the wheel

Moreover, as we have expanded and repeated the induction program, we have become increasingly aware of the need to focus on making the purpose of each component more explicit[1] and to enhance the explicit engagement in double-loop learning[8, 14] and critical reflection[6, 7]. This was achieved by undertaking group and individual reflection at the end of

each activity and component. The contribution of such explication to the learning process is most clearly evidenced by considering the examples in table 4 and figure 3 of three different activities undertaken during components 1 and 2 of the induction program. Activity 1 is completed almost at the start of component 1; activity 2 somewhat later in component 1; and, activity 3 almost at the end of component 2. Here there has been an obvious shift in student thinking from an ill-defined (but not inaccurate), minimalist, linear approach to research, through concept broadening, to a fuller, more organic and realistic view which acknowledges the broader context and motivation of the research experience. It is our contention that the deliberate reflection that occurred between the activities is at least partially responsible for the shift in student responses. Such reflection on action is therefore a powerful method for bringing awareness of processes up to the conscious level[7, 8] of student thinking and in assisting with the vital shift that is necessary if students are to move from their undergraduate apprentice role to that of master of their postgraduate research.

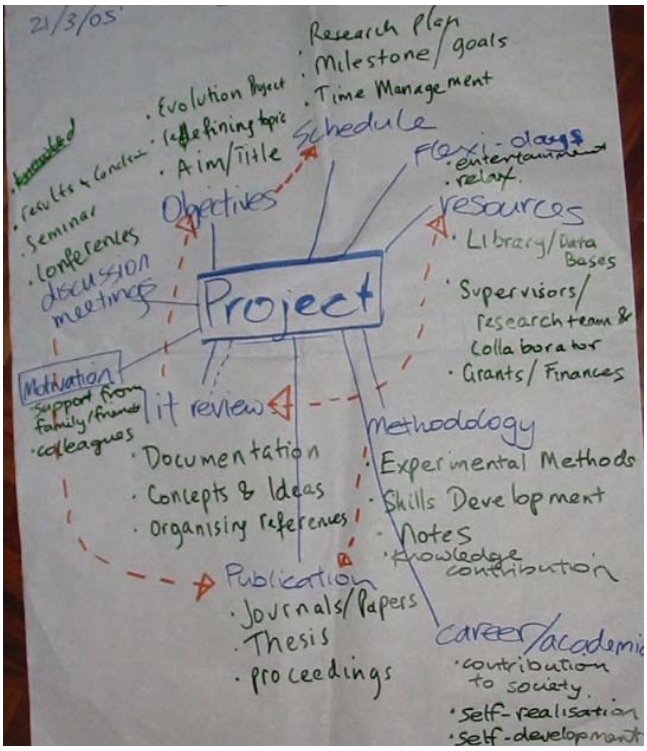

Figure 3. Sample output for activity 3 of induction from S1, 2005.

The students have consistently responded positively to the optional components 5 and 6. These provided opportunities for research students to further explore thinking processes and reassess their strategies and skills. Many students benefited from and valued the opportunity for feedback on their draft writing and practice oral presentations. We were also able to use the questions raised by research students to encourage the group to analyse and discuss important aspects such as: the types of thinking required in their research area, what is valued as good and relevant research, and the relationship between the published literature and the research process. In addition, analysing and critiquing sample extracts of previous research students' writing provided the students with both the concepts and a language to discuss their writing with peers and staff[17].

Supervisor Feedback

The value of the induction program is not just supported by comments of the participants and facilitators. More experienced students who have been involved in the student panels for induction but who did not have the benefit of such a program themselves have consistently recommended continuation of the program and have also suggested development of other modules for later stage research students.

Two recent participants in the staff panel encapsulate the reactions of supportive supervisors.

> "This appears to be providing an effective way of helping assimilate students into their PhD. It is good having some supervisors there for some of it. Interesting to hear the diversity of opinions and guidance being offered by some supervisors but this just emphasises all the more the importance of an induction process like this. Some students will benefit enormously from this induction so please keep them going." (Supervisor S2, 2004)

> "It's good to see this being done these days. I wish I had been so lucky." (Supervisor S1, 2005)

A third staff member has consistently commented on the usefulness of the assessment of student oral and written competencies early in the PhD program in structuring follow-up development and support activities and experiences for her students. While some supervisors are likely to always remain sceptical of any program outside their own involvement with their students, more and more supervisors are becoming convinced of the value of the program as their own students are exposed to it. Recent consultations have shown that all School postgraduate coordinators and Heads of School are more than supportive not only of the program being continued but also of it being converted into a formal course requirement for all new postgraduate research students. This is a marked change from the guarded support given to the concept of the induction program when it was first mooted in late 2002.

Long-Term Impact of the Induction Program

Of course, the real measure of the value of the induction program would come from quantification of long-term impacts[1, 5, 12]. Such indicators might include an increase in publication and completion rates as well as an increase in multidisciplinary research and networking. A more direct measure of the value of the induction program itself was obtained from a recent survey (see table 3) of a small group of ten previous induction participants from four discipline areas which revealed that almost all of them would recommend other students attending the program. All except one student reported finding at least some aspect of the induction program useful in their subsequent research and all reported that they had been completing a variety of writing tasks. Interestingly, information literacy (component 3) was identified as being the most useful part of the program, despite the fact that students had the greatest resistance to attending this component at the time.

From the above discussion it can be seen that we have been actively using experiential and double-loop learning in our reflection on and development of the induction program. Using this methodology, we have come to understand the significance of structuring[11, 12] a program around explicit[1] shared[4, 5] development of skills, research procedures and practical knowledge[1, 5]. A key lesson has been the need to recognise where students are and to be flexible within the components (by reflecting 'in and on' our actions and students' questions) so that individual needs can be addressed, thus keeping the induction program fresh and relevant for all participants. The technique employed for program development is a powerful role model for students and staff of how to go about changing the research culture and improving the student experience.

Conclusions

This paper has described the development of an induction program for postgraduate research students in the Faculty of Engineering at the University of New South Wales. Both the program and the development have been built around the principles of experiential learning, double-loop learning and reflective practice. The program has proven to be successful at challenging and aligning student expectations about research and in encouraging and facilitating the transition from trainee to mature researcher. As the program has progressed, so have the student and supervisor responses to the program. Development of skills in writing and critical reflection are now becoming a valued and integral aspect of the postgraduate research experience in Engineering at UNSW in addition to the more traditionally anticipated development of technical expertise. Support for the program has grown to the point where it will shortly become a credit-bearing course within the Faculty. The program is also being expanded to provide additional support and training for students in later stages of their research degree.

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