Journal of University Teaching & Learning Practice

Volume 7
Issue 2 *Achieving teaching-research connections in undergraduate programs*

Article 8

2010

Why I Wanted More: Inspirational Experiences of the Teaching–Research Nexus for Engineering Undergraduates

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Recommended Citation

Guerin, C., & Ranasinghe, D. (2010). Why I Wanted More: Inspirational Experiences of the Teaching–Research Nexus for Engineering Undergraduates. *Journal of University Teaching & Learning Practice, 7*(2), 117-139. https://doi.org/10.53761/1.7.2.8

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Introduction

Given general agreement on the important and valuable link between teaching and research, what is it about this nexus that inspires undergraduates to want more and become researchers? Much of the teaching–research nexus discussion has focused on integrating research into undergraduate programs, but there is little in the literature about the effect this has on decisions to continue in research careers. In this study, we sought to discover more about the influences on current higher degree by research students' (HDRs) choices to embark on PhDs in various fields in engineering at the research-intensive University of Adelaide by asking them: 'Which aspects of your undergraduate experience of the teaching–research nexus inspired you to undertake a higher degree by research?'.

'Research' and undergraduate programs

Debate about the teaching–research nexus has been wide-ranging and at times controversial. One aspect that concerns us here is the recognition that the concept of 'research' is multifaceted and therefore interacts with teaching in myriad ways. Angela Brew's insightful contribution to this discussion distinguishes between research in the external environment (e.g., presentations at conferences and seminars, publications) and in the internal environment (e.g., developing skills of data analysis, understanding of methodologies) (Brew, 2003). The broad range of skills required in the internal environment is articulated in documents like the *Research Skills Development Framework* (Willison & O'Regan, 2006). However, there are also wide variations in how different disciplines define what constitutes 'research', the complexities of which Trowler and Wareham (2008) reveal by comparing creative disciplines (e.g., graphic design, fine art) with other disciplines (e.g., hard sciences).

Part of the complication in the debate about the teaching–research nexus is the absence of agreement in the terminology used, as well as in the interpretation of those terms (Brew, 2003, 2007; Griffiths, 2004; Healy & Jenkins, 2006; Robertson & Blackler, 2006; Krause, 2007; Simons & Elen, 2007; Trowler & Wareham, 2008; Visser-Wijnveen et al., 2010). Across the literature, the terms 'research-led teaching', 'research-based teaching', 'research-oriented teaching' and 'research-informed teaching' are employed with varying and overlapping meanings attached; the accompanying terms for the student experience are 'enquiry-based learning', 'evidence-based learning', 'problem-based learning' and 'project-based learning'. Consequently, while the benefits of undergraduate research experiences are widely recognised throughout the university sector (for example, Lopatto,

2003), attempts to include 'research' at undergraduate level can look vastly different from discipline to discipline. In Humanities disciplines the tradition of essay writing has always required a variety of research skills, from locating relevant literature and reading critically, to synthesising the information and structuring an argument. In some areas, 'research' has been incorporated into the curriculum through creating more space in traditional lecture time for discussion of academics' own research projects and designing courses that make better use of their research interests and expertise. The introduction of formal and informal research projects in other areas has offered further opportunities for undergraduates to develop broad-ranging research skills.

Engineering education has enthusiastically embraced the opportunity to include project-based activities in undergraduate programs. A 2009 report on the current state of engineering education in Australia points out that 'all Australian and New Zealand engineering degree programs introduce design or project-based learning at the first year level' and include a 'capstone project in the final year' (Godfrey & Hadgraft, 2009). Further, serious discussion leading to the general implementation of problem- and project-based learning has been a feature of engineering education since 1990, as evidenced in the conference proceedings of the Australasian Association for Engineering Education (A^2E^2) (Godfrey & Hadgraft, 2009).

A popular innovation in engineering faculties has been the introduction of various incarnations of undergraduate research scholarships, programs in which undergraduates spend extended periods working on existing or new research projects under the supervision of academic staff. A number of these programs have been studied by education researchers with a view to interpreting their effectiveness and learning outcomes. Zydney et al. (2002) evaluated the benefits for engineering alumni of the University of Delaware who had participated in their Undergraduate Research Program (URP). This study, part of a much larger research project conducted across the whole university by Bauer and Bennett (2003), was designed to gather information about the range of benefits gained by participants, with an underlying interest in the effect the URP had on participants' likelihood of going on to undertake research degrees. They found that a broad range of research skills was effectively developed by those in the program (e.g., critical thinking, analysis of scientific findings, academic seminar presentation), and that the longer the research programs, the better developed these skills became. In addition, considerably more students who had been part of the URP later completed research degrees than those who had not been part of the formal program, indicating a close correlation between involvement in 'real' research projects as an undergraduate and recruitment into doctoral programs. A similar finding is reported by Sweeney et al. (2006) in relation to the nanotechnology Research Experiences for Undergraduates program at the University of Central Florida.

Of course, the meaning of the correlation found by Zydney et al. (2002), Bauer and Bennett (2003) and Sweeney et al. (2006) is open to question. Do students embark on programs such as the URP because they have already set their sights on postgraduate study, or is it the experience of a research project that inspires them to want more? Delatte (2004), reporting on an undergraduate research program in structural engineering, is much less convinced that such programs recruit more PhD candidates than the previously mentioned studies—if anything, his survey suggests a cooling of interest in undergraduates continuing into research degrees. However, he does argue that this may in fact augur well for those who do choose to stay on, in that they now have a more realistic idea of what it is that they are signing up for and therefore make well-informed choices based on personal experience (and, it might be added, may therefore also have a beneficial effect on PhD completion rates).

The following study was designed to explore in more finely grained detail the broad range of 'research' experiences that engineering undergraduates respond to. While the Faculty offers Summer Research Scholarships along the lines of those discussed above, we are also interested in other research experiences that have contributed to undergraduates' decisions to undertake higher degrees by research in engineering, thereby gaining a more nuanced understanding of what inspires these PhD candidates. Of course, there are myriad external factors that play into career choices, not least of which are the economic climate at the time of graduation and perceptions about the social status of academic work. Our concern here, however, is to explore the role of the teaching–research nexus in this complex picture. While we are certainly interested in the effect of experiences that are readily identified as 'research', we are also aware of the need to articulate the variety of ways in which research and research skills can be incorporated into undergraduate programs.

The study

Although the Faculty of Engineering, Computing and Mathematical Sciences (ECMS) has a large undergraduate cohort, it has a disproportionately small number going into research degrees compared to other faculties in the University of Adelaide. One of our aims in this study is to understand more about what is specific to engineering postgraduates' motivations and influences, and to discover which factors of the teaching–research nexus inspired current engineering HDRs to take the leap into research. It is hoped that the findings will help in the recruitment of more engineering graduates into research degrees. The findings reported here are a subset of a bigger, university-wide survey of current HDRs and their undergraduate experiences

of the teaching–research nexus (the initial findings of the study were reported at the Quality in Postgraduate Research (QPR) conference in Adelaide, Australia in April 2010, and the more detailed analysis will be reported at the Pedagogical Research into Higher Education (PRHE) conference to be held in Liverpool, UK in October 2010). This survey was followed by focus group and individual discussions with current PhD candidates in several Schools within the Faculty of ECMS. We wanted to gather information from current HDR candidates, believing they might have somewhat different interpretations of their undergraduate experiences from those who are not currently in the process of doing academic research (for example, the alumni sample of Zydney et al.'s (2002) study). However, we also recognise that there is always an element of memory that is subjective and therefore not wholly accurate and reliable—events in the intervening years may have modified the way in which undergraduate research experiences are remembered. And, of course, in this study we are gathering information from those who succeeded in being accepted into PhD programs and who are still enrolled in those programs (not those who applied but were unsuccessful, nor those who began but have since withdrawn). Nevertheless, these candidates are a valuable source of insights into what works well if we are interested in finding out about inspiring and recruiting PhD students.

The survey

Our project surveyed current HDR candidates, asking 'To what extent does the research–teaching nexus influence the decision of undergraduates to undertake higher degrees by research?' The survey consisted of two parts: the first part enquired about general motivations (15 statements); the second focused in more detail on undergraduate experiences (27 statements ranging from discussion of research being included in lectures, assessment that required some level of research, and involvement in the research culture of the School or Discipline) (see Appendix 1). Participants were invited to indicate the strength of the influence of each element on a 7-point Likert scale, ranging from '1–not at all' to '7–a lot'. In our analysis of the results we have collated responses of 5, 6 and 7 as broad agreement indicating positive, highly influential factors, whereas 1, 2 and 3 are interpreted as being low level influences on the decision to undertake a research degree. There were also opportunities to make qualitative comments at the end of each section of the survey.

Sample population

Approximately 12% of the currently enrolled HDRs in the Faculty of Engineering, Computing and Mathematical Sciences responded to the survey that was sent out to all HDRs in the University. Of the 39 respondents, all except one were enrolled in PhDs or intended to upgrade their Masters degree to a PhD, so we have interpreted the information as referring to PhD candidates. Sixty-two percent were in the age group of 21–30 years, and almost three quarters were male (roughly approximating the overall figures for the Faculty). Two thirds had completed their undergraduate degrees within the preceding five years, suggesting that their memories of undergraduate years are reasonably fresh, with another small spike at the far end of the participating age range (that is, three in the 51–60 age group).

Of those who responded, 59% had done their undergraduate degree at the university where they were currently undertaking their research degree; of the remainder, 13% had finished undergraduate study at other Australian universities, and 28% had done their undergraduate degrees in another country. Given the high percentage of international students in this cohort (and the high numbers in the Faculty generally), we have conducted a comparative study to identify any significant differentiating factors between the two groups. The international students in this particular study comprise 82% Chinese, and the next largest group were Iranian. This is not wholly indicative of the Faculty overall, which also has a large number of students from Malaysia, India and elsewhere. It is perhaps more useful, then, to interpret our results as telling us something about Chinese engineering PhD candidates, than the international cohort as a whole.

Interviews

A focus group was formed with eight postgraduates from different schools in the Faculty (namely, Computer Science, Civil Engineering, Electrical and Electronic Engineering, Chemical Engineering and Mechanical Engineering) in an effort to garner a wide range of opinions and experiences within the overall Faculty. An individual interview was also held with a participant who was willing to provide feedback to the project, but who was unavailable to attend at the time scheduled for the focus group. Participants were recruited by direct email; some were already known to the researchers, and others were approached without previous introduction.

The participants (3 females and 6 males) were from a range of cultural and national backgrounds: Australia, China, Singapore, Iran, Israel and Indonesia. Although not proportionally representative of the cultural mix in the Faculty, this group did offer something of the multiplicity of voices to be heard across the various Schools of Engineering in the University.

Findings and discussion

1. General Motivations

The general motivations that received the highest overall ratings (that is, receiving the most scores of 5, 6 or 7 on the Likert scale) as being influential in decisions to undertake research degrees were:

- I wanted to do my own research (92%)
- I am driven by a desire to invent/create/discover new things (92%)
- I wanted to find out more about the topic I am studying (77%)

Of these top three motivators, wanting to find out more about the topic received the most responses at the highest rating (exactly one third of the respondents chose '7–a lot' for this category). This was closely followed by 28% choosing 7 for wanting to do one's own research, and 26% chose the highest rating for being driven by a desire to invent/create/discover new things. These are clearly powerful motives for beginning long-term study commitments.

Interestingly, while family and friends rated amongst the very lowest overall motivators for current postgraduates' decisions to continue into research degrees, this element was revealed as one of the main motivators for the international students. More than half of the Chinese respondents ranked this as 5 or more, and a further two thirds attributed a strong influence to the encouragement of other family members in their decision. This compares to only 30% of local students reporting parents as strong motivating factors in their decision making, and an even lower 11% being influenced by other family members. Of course, the sample size in our survey is limited, so it is important not to make too much of it. However, the figures do fit the received notion that Asian students are more influenced by their parents' wishes than are local Australian students (who, one must remember, come from families of very diverse national and ethnic backgrounds, including many Asian countries). This was again borne out in the focus group discussion, in which

two international students explained that family pressure and expectations were particularly strong: '*in my family there wasn't anything more important than studying*'. Another participant explained that, as far as his parents were concerned, he had to be a doctor or a lawyer (a PhD in engineering was his compromise position).

Employers were not credited with promoting the aspirations of engineers to undertake research degrees—18 out of 39 respondents ranked this as a very low influence, far and away the most consistently negative response. Only one participant responded with a 7 for this element. The reasons for this lack of influence from employers are no doubt many and varied, but certainly corroborates the anecdotal evidence that employers are looking for hands-on, practical engineers, not researchers driven by a fascination with theoretical issues. This is supported by the work of Adams et al. (2006), in which it is found that engineering PhD candidates suspect that a research degree may in fact reduce their desirability to industry employers.

2. Undergraduate Experience

In response to the statement, 'As an undergraduate I was inspired to do a higher degree by research because…', the highest rating items were:

- I enjoyed doing project-based work (64%)
- Lecturers were passionate about their own research (58%)
- I enjoyed working on a vacation research scholarship (57%)

The detailed analysis of research elements reveals some striking differences between local and international students (Table 1).

Table 1. Highest rating items in 'Motivations'.

	Overall	Local	International	Chinese
I enjoyed doing project-based work	64%	54%	100%	100%
Lecturers were passionate about their own research	58%	No significant differences	No significant differences	No significant differences
I enjoyed working on a vacation research scholarship	57%	No significant differences	No significant differences	No significant differences

While 64% of the total survey population reported being positively influenced by project-based research, 100% of international students credit this as an important influence, and of those, about half rate it at '7-a lot'. The parallel figure for local students is, by contrast, only 54% who regard this as an influential factor in their decision to undertake research degrees. This may be attributed to a number of different factors, and they may not all apply to all students. However, there is anecdotal evidence that local undergraduates do not always enjoy team-based projects, particularly their implications for assessment. In contrast, the focus group discussion revealed that it was the realisation that all the theory could be applied to real-world situations and '*you do a lot of practical work that can be implemented, that can help people*'. More satisfying experiences of project-based work might well raise the number of students entertaining the idea of continuing into research degrees.

In the overall university survey, encouragement from lecturers to go into research was a moderately influential factor in the decision to undertake a PhD (50% in the engineering group ranked this as 5 or above). In addition, the general postgraduate population also claimed that they were often inspired by lecturers who were passionate about their own research, although the breakdown by faculty reveals that only 17% of engineering respondents saw this as an important influence on their decision.

When it came to the focus group, however, a number of the participants declared that it was the encouragement of individual lecturers who took a particular interest in them that paved the way for their entry into research degrees. For example, one interviewee explained that his supervisor '*grabbed onto me and didn't let go!*'. Another declared that researchers appeared to him to be the kind of people who '*wanted to get things right , to be perfect … to pursue the right thing – I think that it is a good attitude*.' In the large undergraduate classes facing lecturers today, it is challenging to pay individual attention to promising students. However, if such opportunities do become available, it certainly appears to be a valuable investment in recruiting HDR candidates.

Reading materials

A further discrepancy between local and international students lies in their reported enjoyment of reading the literature published in their field (Table 2). While only 18% of local students gave a high rating for reading extra materials provided by their lecturers, 82% of internationals rated this as 5 or more, and this goes up to 89% if we look at the responses from only the Chinese students.

Table 2. Ratings for reading materials.

	Local	International	Chinese
current journals	29%	73%	78%
encouragement to read cutting-edge research	25%	82%	89%
books by lecturers	4%	64%	66%

This last might be explained by the fact that our own lecturers may not be in a position to use textbooks they have written themselves in the courses they teach (whereas this is a much more common practice in China). Figure 1 indicates the limited influence of reading materials in terms of the weighting towards both the lowest end of the scale ('1' responses) and also the high number of 'Not Applicable' responses. Nevertheless, the other results suggest that reading the literature is an aspect of the teaching–research nexus we could mobilise more effectively to inspire local students to move into research careers. Indeed, when the focus group was asked about the inspirational effect of reading articles, several indicated that this was a key aspect of their initial interest in research. For example, one student described a compulsory subject in his engineering degree from third year onwards that operated along the lines of a journal club. Reading research papers and presenting them to the group was perceived as a valuable experience that opened his eyes to the exciting possibilities of research. Another student explained that his own interest in research was sparked when his roommate was reading articles about an interesting topic, so he also read the papers to find out what it was all about. Both of these experiences took place in universities outside Australia, however, and local students did not appear to have the same kinds of opportunities or encouragement when they were undergraduates.

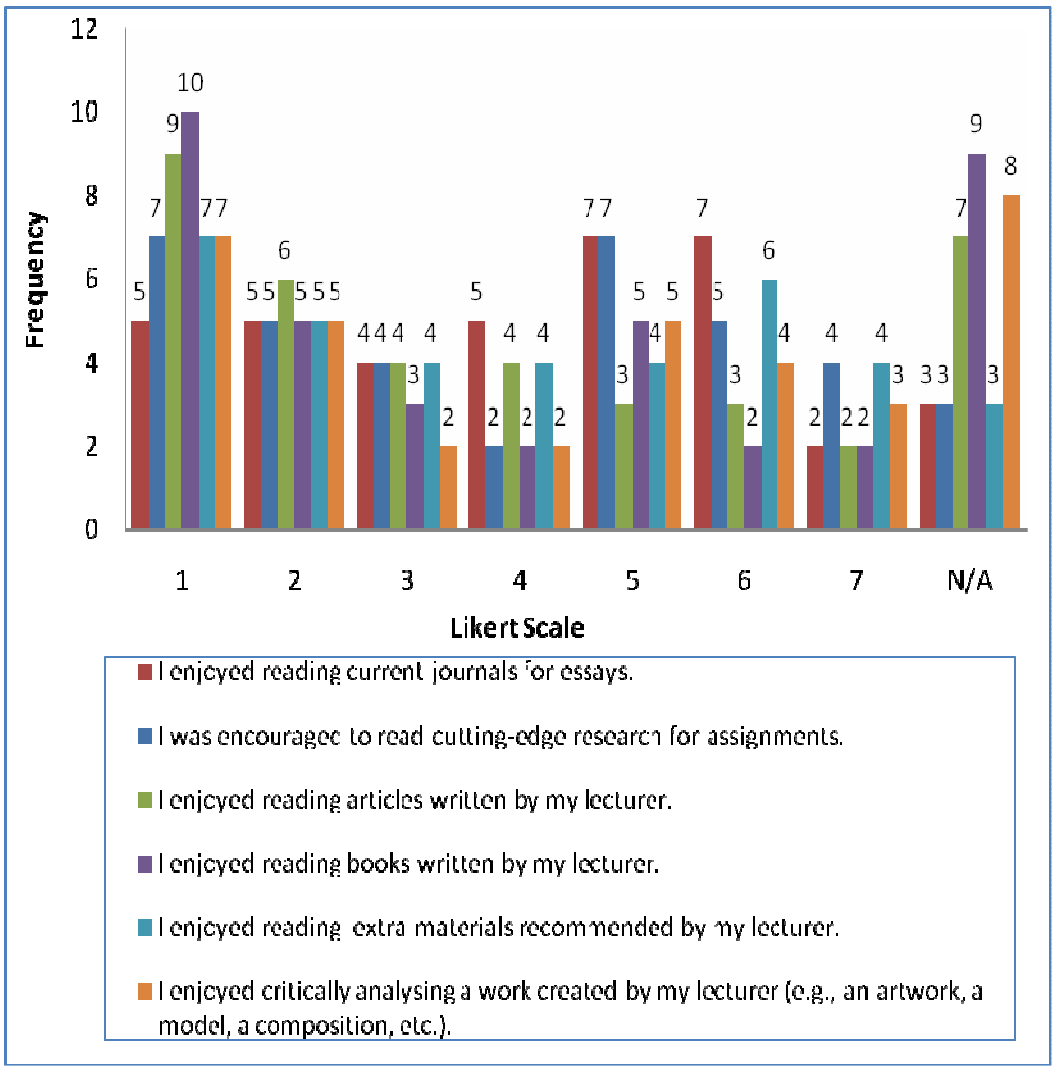

Figure 1. Responses to survey questions on the influence of reading materials on the decision-making process of HDR candidates.

In a few cases, respondents left some elements blank, hence some variation in the number of responses.

And finally, the statement 'I enjoyed critically analysing a work created by my lecturer (e.g., an artwork, a model, a composition, etc.)' was rarely chosen as a strong inspiration. This may reflect the fact that there are few opportunities for such activities in the academic context of engineering education (and, perhaps, any design work undertaken as industrial consultancies may be confidential).

Lecturers' influence

Responses in relation to lecturers citing and discussing their own research were heavily weighted towards the lower end of the scale, as demonstrated in Figure 2, even though on balance the statement about lecturers being passionate about their own research was generally inspirational. There may be some overlap here between the 'Not at all' an influence and the 'Not Applicable'—maybe lecturers did not have many opportunities to relate their research to their teaching, and perhaps the more charismatic lecturers appeared to be passionate about research as well as everything else they talked about. A high number of students also reported that lecturers' publishing in top journals was not inspirational for them, which may mean that as undergraduates the students were not actually aware of their lecturers' publication records. Guest lecturers and postgraduate lecturers were also regarded as uninspiring (indeed, postgraduate guest lecturers were the only factor that received absolutely no 7s in the entire survey!).

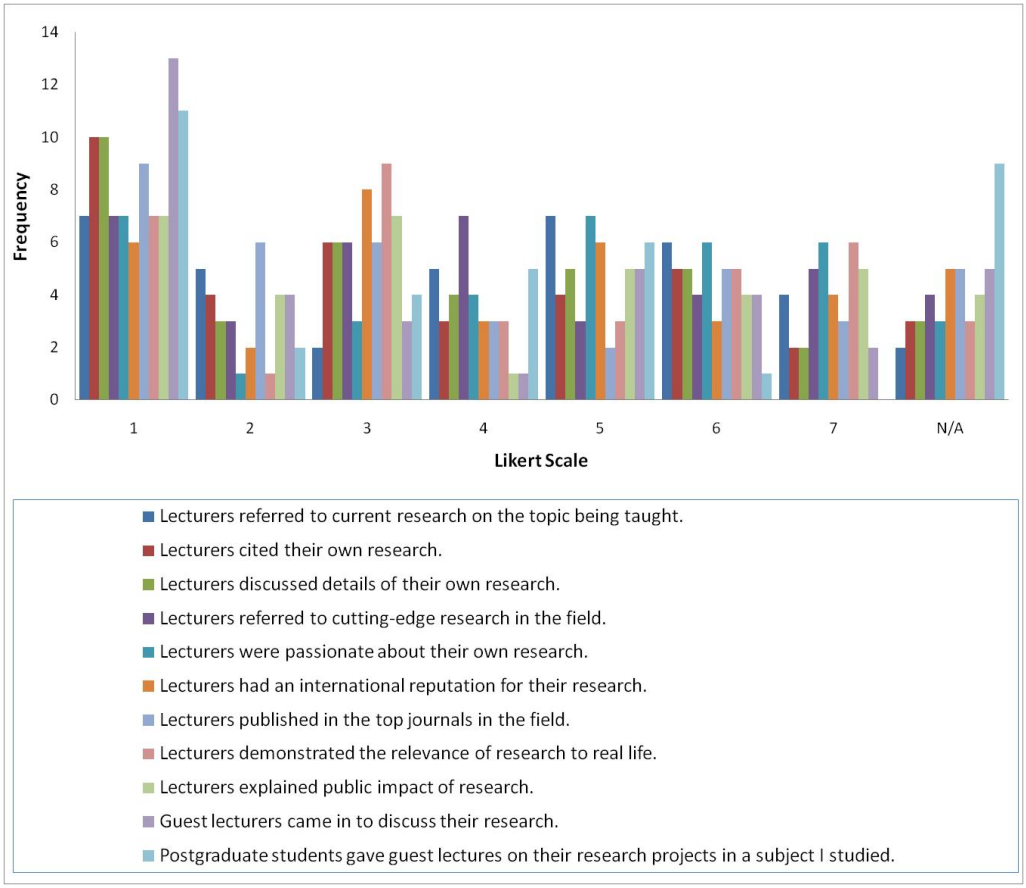

Figure 2. Responses to survey questions on the influence of lecturers on the decision-making process of HDR candidates.

Important differences emerge if we conduct a comparative study between local and international HDRs. For all of the statements beginning 'Lecturers…', at least 50% of the international students reported positive influences of 5 or greater, while these factors all received 21% or less from local students. The greatest disparity occurs where 82% were influenced by lecturers demonstrating the relevance of research to real life and the public impact of research, compared to only 18% of local HDRs for the same factors. The lowest response appears in relation to the effect of lecturers publishing in top journals in the field: only 7% of local students responded positively to this, while it was regarded as inspiring for 64% of international students. Lecturers discussing details of their own research received slightly closer responses (55% for internationals, compared to 21% of locals).

The reasons for this difference between local and international experiences are no doubt many and varied. The results may indicate the influence of cultural differences in relation to the regard in which academic staff are held, and the kinds of students that gain university places in different countries. It may also indicate something of the place of research in different universities here and abroad, or it may reflect the teaching styles in different universities. Whatever the reasons, it would seem that this is a missed opportunity for our students at present. If these elements are capable of playing a role in switching some undergraduates on to the excitement and satisfaction of a research career, then perhaps it is possible to harness this element more effectively to inspire undergraduates to undertake higher degrees by research.

Research life of the School

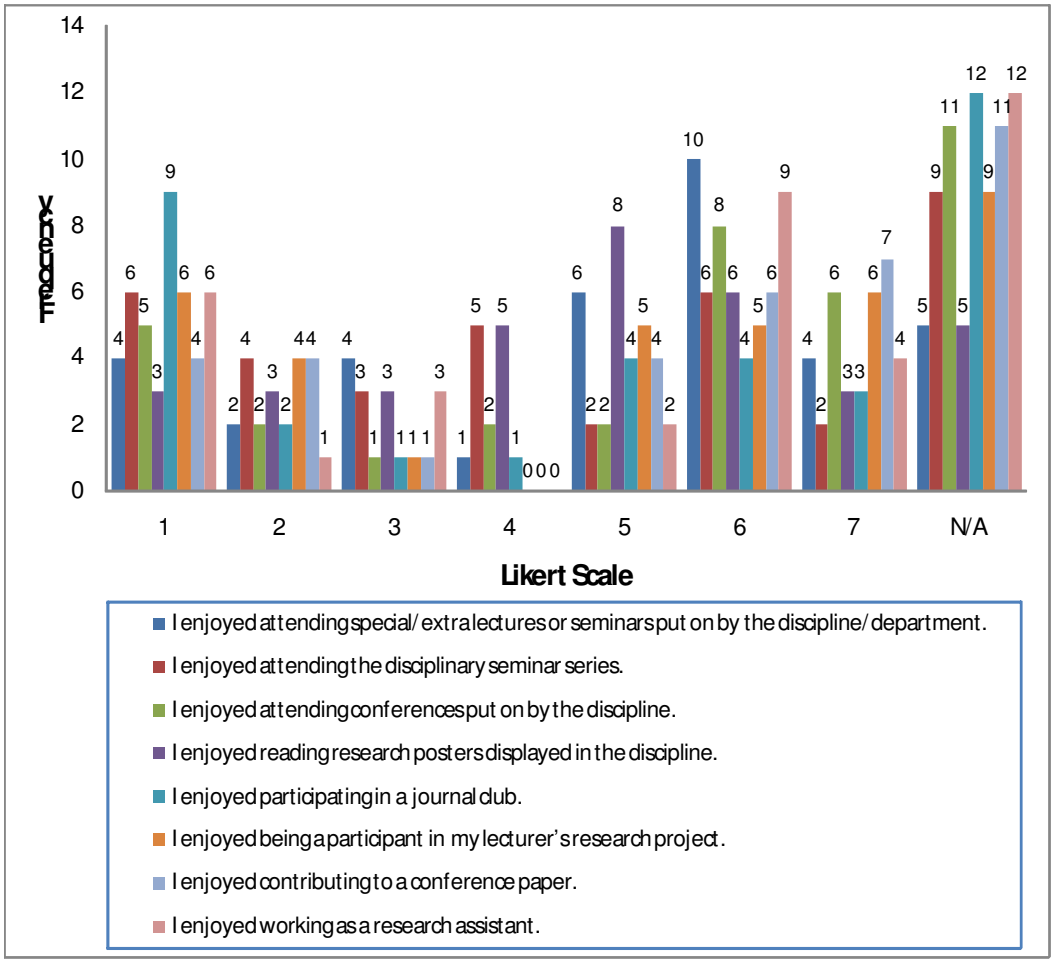

Figure 3. Responses to survey questions on the influence of Research life of the School on the decision-making process of HDR candidates.

Figure 3 reveals that the most significant number of Not Applicable or blank responses appears alongside the elements related to the research life of the School itself. For example, few students responded positively to the questions about participating in journal clubs or participating in a lecturer's research. Forty-three per cent of local students reported Not Applicable in relation to contributing to conference papers, but 82% of the international students reported that this was inspiring for them—obviously they must have had more opportunities to engage in such activities. Even stronger differences emerge in relation to experiences of working as a research assistant: half of the local students said that this was Not Applicable to them. By contrast, all but one of

the international students reported that this was highly influential (scoring 6s and 7s) in their decision to embark on a research degree. Indeed, a question during the focus group discussion about the research life of the School received rather blank responses from local students—they declared that it had been 'invisible' to them as undergraduates. Again, perhaps this largely untapped area could be exploited to encourage undergraduates into research degrees.

Certainly, it is this contact with the world of research during their undergraduate experience that a number of the focus group participants stated as being a positive influence on their own awareness of research as a possible future path. There was one local mature-age student, though, who was inspired when he heard a lecturer talking about his own research in lectures; he followed up by searching out the publications referred to and found himself thinking: '*One day I'll put my name on one of those papers*'. It would seem that we could make much more of such opportunities to introduce the notion of the research that is currently being undertaken in our local context, so that undergraduates realise this is a vibrant part of university life that may well hold future careers for them.

Vacation research scholarship

Not all students undertake vacation research scholarships (28% responded as Not Applicable or left this question blank—local students in the focus group had no memory of being told about the existence of such scholarships even). However, of those who did participate in such schemes, 57% reported that this was a factor in encouraging them to go on to further research—indeed, 21% awarded this the highest rating of 7 on the Likert scale. Clearly, if managed appropriately, vacation research scholarship schemes can be an effective inspiration and recruitment tool for HDR candidates. Certainly, there is some evidence from engineering faculties in the US to support this view (Sweeney et al. 2006; Zydney et al. 2002). The reasons for this correlation are many, and include the direct personal contact with academic staff and mentors, as well as the first-hand experience of doing intensive, extended research which has direct application to the real world. This practical application was also regarded as a crucial moment in recognising the possibilities of a research career for one focus group participant: '*For me the turning point may be I found that the knowledge could be used … you do a lot of practical work that can be implemented, that can help people*'. Perhaps the practical application of theoretical concepts in a research project like the vacation research scholarships is the ideal means of demonstrating the satisfactions of research to engineers.

Honours projects

Closely linked to the vacation research scholarships are the positive experiences of research undertaken as part of Honours projects. One survey respondent took the opportunity to add the following qualitative comment: '*Main reason was that as an engineer (Civil) a major component of 4th year is your honours research project. Ours was very interesting and impacted my decision to return to uni*'. While local students in the focus group identified this transitional aspect of their undergraduate degree as an important motivator in deciding to continue along the research path (although there were reservations here—such projects can also be devastatingly boring if not well conceived), some international students described similar systems in their previous universities to introduce students to research. For example, one student described a Chinese system in which all undergraduates in computer science were required to be involved as programmers in the research projects in the school from their third year onwards. Graduate students and professors supervised the work, and undergraduates, acting as a kind of research assistant, were asked to read relevant papers and then implement the ideas therein. In this way they developed research skills and had a good idea of what research in their area involved. An Indonesian student explained that her course included a compulsory research skills subject in which lecturers '*wanted to give us the habit*' of doing research. Although these undergraduate courses are not always labelled as 'Honours projects' in other university systems, their content and effect would appear to be similar.

Conclusion

Although it may be argued that the sample of students, while being representative of the university HDR student population, is small, the data indicate some strong trends that can be cautiously extrapolated to the general population of PhD candidates in engineering disciplines. There are a number of lessons we can extract from our research about the influence of the teaching–research nexus on undergraduates' decisions to embark on research degrees. While current postgraduates report their inspiration coming from early experiences of 'doing research' (in the form of project-based courses, Honours projects or vacation research scholarships), on closer investigation other less direct experiences of research also played into their decision-making in powerful ways (e.g., reading cutting-edge research, contributing to conference papers).

Personal encounters and relationships seem to be key influences in getting students to think about the possibility of themselves as researchers. Given the increasing class sizes in undergraduate programs, this personal aspect is a challenge, yet the pay-off would appear to be substantial when it is acted upon.

The data certainly supports moves in engineering undergraduate courses to allow for project-based assignments—a high percentage of current research students indicate that these experiences of research were an important influence in their decisions to continue. Of particular interest is the significant impact of the summer scholarship program conducted by the ECMS Faculty. Our results have shown that of those who took up these scholarships, a high percentage decided to pursue a research degree, indicating that these kinds of schemes are a valuable strategy in attracting HDR candidates. We hope that our study will encourage the general expansion of such programs. However, we would sound a note of caution here: despite the high transition rate of these students into research degrees, only a little more than half of the engineering students who undertook a vacation scholarship and went on to do a PhD actually enjoyed their project. This suggests that there is significant room for improvement in the design of these scholarship programs, and that such adjustments are likely to further increase the rate at which these students then choose to pursue higher degrees by research. When the satisfactions of project-based assignments are put alongside the importance of vacation research scholarships as inspiration to undertake research degrees, it is possible to speculate that perhaps students who have these opportunities as undergraduates have a clearer and more realistic idea about what a long-term research project might entail. Whether this has any impact on completion and withdrawal rates is yet to be determined, but it may well play a significant role in candidates being well-prepared for what lies ahead.

Taken together, the survey results indicate that a genuine interest in research is the driving factor behind the majority of PhD students' decisions to undertake research degrees, and that this usually seen in terms of career options. For those of us working in higher education, these aspirations must be taken seriously and nurtured in both practical and educational ways. If we can create environments that encourage talented, curious undergraduates to develop research skills, and can provide well-resourced opportunities for them to exercise those skills, the pool of potential PhD candidates is likely to grow significantly. This in turn may well have a positive effect on recruitment of engineering research degree students.

Appendix 1

The teaching-research nexus and undergraduates' decisions to undertake research degrees

The following survey seeks to find out what experiences during your undergraduate study influenced your decision to undertake a research degree. In particular, we are interested in what experiences of 'research' (in all its possible forms) may have contributed to this decision.

Motivations

These questions ask for information about what generally motivated you to undertake a Higher Degree by Research. You can tick as many responses as you think are appropriate.

	1 = not at all						**7 = a lot**
I want to do my own research	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I am driven by a desire to invent/create/discover new things	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I want to find out more about the topic I am studying	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I want to be an academic	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I was encouraged by my lecturer	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I was encouraged by my parents	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I was encouraged by other family members	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I was encouraged by friends	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I was encouraged by fellow students	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I was inspired by media coverage of my field (e.g., tv, internet)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I need a research degree to practice in my profession	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I want to enhance my existing career	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I want a change of career	**1**	**2**	**3**	**4**	**5**	**6**	**7**
My employer provided the opportunity	**1**	**2**	**3**	**4**	**5**	**6**	**7**
My government provided the opportunity	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Other (please state)	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Undergraduate experiences of the teaching-research nexus

These questions ask you about what aspects of your undergraduate experience (that is, before your Honours year) inspired you to undertake a Higher Degree by Research.

As an undergraduate I was inspired to do a Higher Degree by Research because:

	1 not at all						**7 a lot**	
Lecturers referred to current research on the topic being taught.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Lecturers cited their own research.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Lecturers discussed details of their own research.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Lecturers referred to cutting-edge research in the field.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Lecturers were passionate about their own research.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Lecturers had an international reputation for their research.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Lecturers published in the top journals in the field.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Lecturers demonstrated the relevance of research to real life.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Lecturers explained public impact of research.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Guest lecturers came in to discuss their research.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Postgraduate students gave guest lectures on their research projects.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed doing project work (e.g., lab-based, data-based, field-based, literature-based research projects).	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed reading current journals for essays.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I was encouraged to read cutting	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**

edge research for assignments.								
I enjoyed reading articles written by my lecturer.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed reading books written by my lecturer.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed reading extra materials recommended by my lecturer.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed critically analysing a work created by my lecturer (e.g., an artwork, a model, a composition, etc.).	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed working on a vacation research scholarship (e.g., Adelaide Summer Research Scholarship (ASRS), TQEH Research Foundation Scholarship, CSIRO Vacation Scholar ship Scheme, etc.).	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed attending special lectures put on by the discipline.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed attending the disciplinary seminar series.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed attending conferences put on by the discipline.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed reading research posters displayed in the discipline.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed participating in a journal club.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed being a participant in my lecturer's research project.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed contributing to a conference paper.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
I enjoyed working as a research assistant.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**N/A**
Other (give details)								

Do you have any further comments about your experience of 'research' as an undergraduate?

General demographic information

We need some information about you and your background.

Age 21-25 26-30 31-35 36-40 41-50 51-60 over 61

Gender Male Female

Nationality/country of birth_____

Number of years since finishing your undergraduate degree _____

Work experience since finishing your undergraduate degree _____

Educational background

We need some information about your educational background.

Where did you do your undergraduate degree?

At Adelaide University
At another Australian university
In another country (give details)

Which faculty are you in?

Sciences
Health Sciences
Professions
Humanities and Social Sciences
Engineering

Which discipline/research group are you in?

Which type of research degree are you enrolled in?

Masters by research
Masters by research (wanting to upgrade to PhD)
PhD

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