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Published online: 05 Jan 2017.

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Academics' perceptions of the challenges and barriers to implementing research-based experiences for undergraduates

Angela Brew[a] and Lilia Mantai[b]

[a]Office of the Pro-Vice-Chancellor (Learning and Teaching), Macquarie University, Sydney, NSW, Australia; [b]Department of Educational Studies, Faculty of Human Sciences, Macquarie University, Sydney, NSW, Australia

ABSTRACT

How can universities ensure that strategic aims to integrate research and teaching through engaging students in research-based experiences be effectively realised within institutions? This paper reports on the findings of a qualitative study exploring academics' perceptions of the challenges and barriers to implementing undergraduate research. Academics were asked about perceived constraints and enablements, how they defined undergraduate research, the forms of undergraduate research used, and they were encouraged to provide examples. Perceived constraints included particular institutional policies and structures, academics' mindsets and lack of skills and questions of time and money. It was found that different definitions of undergraduate research lead to different practices and varying opportunities for further development. This paper presents different forms of engagement in undergraduate research allied to these different definitions and it draws on interviewees' ideas about what has been enabling in their context to suggest possible strategies for institutions to move forward.

Introduction

The ability to think critically, to analyse problems and to make decisions in the face of complex knowledge is required of all professionals in the twenty-first century. This realisation has led universities to see research and inquiry as important in students' development (Boyer Commission 1998). To bring this about, the integration of teaching and research has been seen as fundamental to contemporary higher education (Hattie and Marsh 1996). But such integration is not straightforward. A study of institutional missions carried out in Australia in 2009 found that almost all included the desire to bring research and teaching closer together. Yet, many institutional quality audit reports highlighted a lack of implementation strategies to support such aspirations (Brew and Cahir 2014). So what strategies are helpful and what impedes such developments?

CONTACT Angela Brew ✉ angela.brew@mq.edu.au ⬤ Office of the Pro-Vice-Chancellor (Learning and Teaching), Building E11A, North Ryde, Macquarie University, Sydney, NSW 2109, Australia

The large body of international research literature on the integration of research and teaching has moved in the last 15 years from teacher-focused approaches emphasising the incorporation in curricula of knowledge derived from research, to a focus on creating strategies for students to learn through various forms of research and inquiry (see e.g. Brew 2003; Hattie and Marsh 1996; Healey and Jenkins 2009). A variety of strategies has been suggested. These include providing opportunities for staff to extend their understanding of what is required and opening up opportunities for students to carry out and to present their research (see e.g. Brew 2013). In addition, the literature is replete with models of undergraduate research engagement (Brew 2013; Healey and Jenkins 2009) and examples of good practice (e.g. Karukstis and Elgren 2007).

In parallel with the literature, institutions attempting to integrate research and teaching, have increasingly emphasised in their missions, policies and strategic planning, the creation of opportunities for students to engage in or experience research (Brew and Cahir 2014). In some cases, this is in a bid to develop student engagement since undergraduate research has been shown to enhance it (Kuh 2008).

Educational innovation in universities has traditionally focused on the few committed individual experimenters in a cascade model of development (Middlehurst and Elton 1992). This is changing through national initiatives such as the grants and fellowships of the UK's Higher Education Academy and the Australian Office for Learning and Teaching with a larger number of committed individuals enabled to spread their innovations to the wider community. However, the question remains as to how to effect wide-scale change. How can universities ensure that hopes and aspirations expressed in their strategic institutional documents are realised across the institution in practice? Specifically, how does a university with a commitment to widespread undergraduate research engagement move forward? What gets in the way of widespread adoption and what is likely to facilitate it? These are the questions addressed in this paper.

The paper is based on research conducted at a large research-intensive university in Australia where a research-enriched environment for teaching and learning was a key strategic priority. A number of investigations into practice were conducted. These included: examining students' views of research (Hajdarpasic, Brew, and Popenici 2015); researching the visibility of research on campus (Popenici and Brew 2013); engaging undergraduate students in pedagogical research; and researching the outcomes of undergraduate research experience programmes (Brew and Jewell 2012). Information gained from these studies was fed into cross-departmental discussions in a working group consisting of representatives of departments nominated by deans. During these discussions it became evident that practice in engaging undergraduates in various forms of research and inquiry was growing but a number of stumbling blocks still limited development. This issue led to the investigation reported in this paper.

Undergraduate research may encompass opportunities both within the formal curriculum and courses and also apprenticeship-style (Zimbardi and Myatt 2014) undergraduate research experiences which are mainly outside formal courses, perhaps in vacation scholarship schemes and various kinds of internships where students conduct research alongside academics. The study interviewed a sample of academics who were known to be interested in, or who had expressed views about developing undergraduate research to find out how individual academics worked to implement research-based experiences for

students and what the challenges and barriers were. We found that the challenges and barriers were relatively easily identified but how academics talked about undergraduate research varied. Some forms of undergraduate research opened themselves to widespread development whilst others closed off opportunities. In this paper, we argue that how academics define undergraduate research is key to understanding how to develop it across a university because academics' views are critical determinants of the forms of undergraduate research that they implement.

The paper first explores the background literature, then, after a discussion of the mode of inquiry and the theoretical framework for the study, we outline what academics perceived to be the constraints to spreading undergraduate research. This leads to a discussion of the different ways in which academics described and defined undergraduate research. We then provide examples of different forms of undergraduate research engagement and discuss the capacity for each form to facilitate or to hamper the spread of practice. Finally, we discuss the key determining aspects of how universities can move forward in implementing research-based experiences for students.

Background

The last three decades have seen an increase in efforts to promote undergraduate research worldwide. This development is perhaps more visible in the US due to the work of the Council on Undergraduate Research (CUR), established in 1978. Significant advances are being made across the globe through programmes that help introduce and scaffold undergraduate research experiences not just in final year dissertations as is typical in the UK, but throughout the entire curriculum, such as students as producers (Neary and Winn 2009), students as partners (Cook-Sather, Bovill, and Felten 2014; Healey, Bovill, and Jenkins 2015), the Australian Research Skills Development Framework (Willison and O'Regan 2007), as well as worldwide national and international conferences and publications dedicated to communicating undergraduate research achievements.

Undergraduate research as a learning experience forms a vital and powerful link between research and teaching, (Brew 2003; Brew and Boud 1995; Healey, Jordan, Pell, and Short 2010; Van der Rijst, Visser-Wijnveen, Verloop, and Driel 2013). CUR defines undergraduate research as 'an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline' (Beckman and Hensel 2009, 40). However, there is recognition that definitions vary widely and that even within institutions they are often implicit making conversations about undergraduate research engagement difficult (Beckman and Hensel 2009).

The benefits to students, academic staff and institutions are well established (see Dolan and Johnson 2009; Healey 2005; Healey et al. 2010; Laursen et al. 2010; Lopatto 2009; Potter et al. 2011; Wayment and Dickson 2008). Much of the US literature on the benefits focuses on apprenticeship-style undergraduate research lying outside the formal curriculum (e.g. Laursen et al. 2010).

The literature on undergraduate research also clearly highlights the value for institutions. Undergraduate research has proven to increase retention and increase graduate school enrolments (Moore, Avant, and Austin 2008). In fact, the literature on undergraduate research has mainly focused on showcasing the benefits for students, good practices and successful programmes.

Relatively less discussed, but increasingly more in the last decade, are the benefits that undergraduate research affords academic staff engaged in supervising undergraduate research. Some research reveals such academics draw personal satisfaction from teaching students to become critical thinkers, independent scholars and responsible citizens (Greenawald 2010; Potter et al. 2011). Further, academics gain motivation and renewed enthusiasm for their work (Malachowski 2003). Postdoctoral and graduate students who supervise undergraduate research say they enjoy their work more, enhance their communication skills and improve their qualifications and career options (Dolan and Johnson 2009).

Grobman (2010, 372) highlights the role of supervisors or mentors in her description of 'undergraduate research as educational and comprehensive curricular movement that involves students as apprentices, collaborators, or independent scholars in critical investigations […] under the sponsorship of faculty mentors'. The term 'sponsor' used here implies a kind of investment that goes beyond the formal requirements and provision of guidance.

The literature suggests that the role of the supervisor and the relationship between supervisor and student are essential factors in a positive research experience. Hence, the attitudes and views of the supervisor are critical and require special attention in an investigation of constraints in implementing undergraduate research experiences. Little research, however, has attempted to ask academic staff what they perceive to be the challenges to implementing undergraduate research. A meta-analysis of the factors that enable and constrain the use of inquiry-based learning carried out in New Zealand by Spronken-Smith et al. (2011) revealed a number of barriers and suggested possible strategies to move forward, that is, implementing clear criteria for assessing research outcomes, integrating reflection in the research process, applying a community of practice approach and employing senior staff as mentors. Another study found that academics' orientation towards teaching or research impacts undergraduate research participation. It concluded that research orientation hinders undergraduate research education (Hu, Scheuch, and Gayles 2009). Wilson et al. (2012) concur that academics' beliefs and definitions of learning and teaching influence their actions and attitudes towards undergraduate research. These beliefs, in turn, are shaped by academics' personal experiences of research training and socialisation, as undergraduate research supervision notoriously enjoys little formal training (Wilson et al. 2012). In a study of the teaching of research skills in social sciences, Wagner, Garner, and Kawulich (2011) found that academics lack the knowledge base in respect to the pedagogy of developing research skills. In an earlier study, Armstrong and Shanker (1983) suggested that the supervision of undergraduate research and research skills varies in different disciplines.

In relation to perceived constraints, structural issues are widely articulated. Lack of time, shortage of workspaces (Lei and Chuang 2009), institutional focus on research, lack of recognition or rewards for undergraduate research supervision (Wayment and Dickson 2008) and funding constraints (lack thereof, inflexibility or tight timelines) are predominant in such accounts. Katkin's report (2003) investigates the changes stimulated by the Boyer Commission (1998) five years after its publication and discovers that research and teaching are still seen as conflicting practices. The Boyer Commission report (1998) postulates that every student should have access to research experiences. However, the reality shows that such learning opportunities traditionally reach the privileged minority of academic high-achievers. Overall, the literature suggests that supervision of

undergraduate research is seen not as integral to academic practice but as a 'burdensome' and 'troubling' extra that adds to the commonly assumed high academic workload (Lei and Chuang 2009). Studies that highlight this notion disregard the potential that undergraduate research supervision carries in motivating and nurturing academics in pursuing and continuing research.

To date there is an evident lack of in-depth investigation of what constrains and enables the implementation of undergraduate research experiences at institutions that believe in the value of undergraduate research and wish to implement such experiences more widely. Our research addresses this gap. We asked academics what they perceived to be the challenges and the barriers to implementation.

Approach

A cascade approach was used to identify research participants. Members of the strategic working group on undergraduate research that had existed for three years prior to the interviews were invited to participate and to suggest other individuals to interview. This resulted in 28 academics interested in developing undergraduate research being invited to participate. Following ethics approval, 20 semi-structured interviews were conducted. Interviews lasted approximately an hour. This approach had the advantage of including academics committed to the development of undergraduate research but the disadvantage that half of the interviewees were known to the interviewers professionally prior to the interview. Also it did not include staff hostile to, or ignorant of, such developments. These factors do not negate the findings, but it must be recognised that the sample is a deliberately biased one.

Of the 20 research participants, 9 had a formal or recognised role to develop undergraduate research. This was not necessarily related to their academic level which ranged from lecturers (3), senior lecturers (5), associate professors (9) and professors (3). Equal numbers of male and female interviewees came from a wide range of disciplines with most coming from social sciences and science (see Figure 1).

The interview questions were designed to surface academics' perceived constraints and enablements in implementing research and inquiry-based learning. Critical realist ideas drove the design of this study, particularly the work of Archer (2007). She argues that people find themselves in ambiguous social situations that present a complex variety of conflicting opportunities to act as they wish, and that they balance the freedom they have against particular personal, institutional and structural constraints as they perceive them (Archer 2007). They use 'internal conversations' to work out how to fulfil their own needs, desires and values within institutions (Archer 2007). The focus on enablers and constraints in this study is consistent with her notion of social structures that are interpreted by agents acting according to their values.

Academics were also asked whether they had a role to spread undergraduate research in their department and what actions they had taken. They were asked about academics' research practices in their department, their views on how important research is to the discipline and its influence on the curriculum. They were also asked to define undergraduate research and, throughout the interview, to provide examples. An interpretivist approach was used in analysing the data. An iterative, thematic analysis of the transcribed interviews was conducted to identify constraints and enablers.
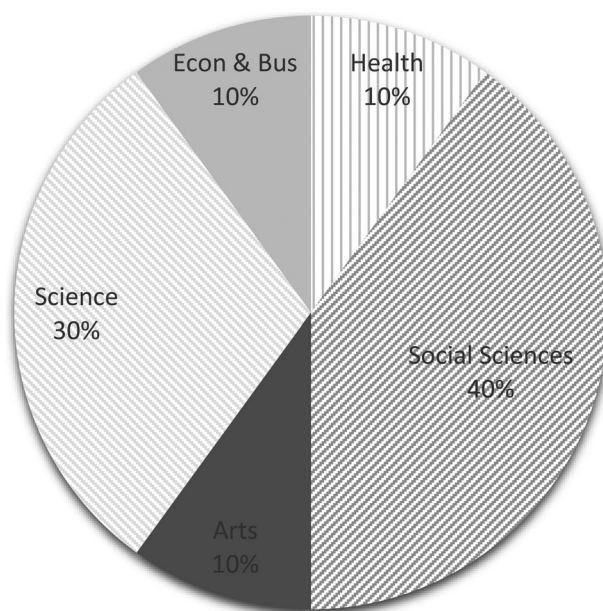
Figure 1. Research participants' faculties.

The findings are presented in the following four sections. Firstly, we discuss the perceived key constraints in spreading undergraduate research. Then interviewees' definitions of research are discussed. We then present a model setting out the different forms of undergraduate research engagement mentioned in the transcripts. Finally, in the discussion section we present interviewees' suggestions for what enables undergraduate research development. To preserve confidentiality, in this paper, interview transcripts are identified by a number. Quotations are followed by the transcript number, the page location of the transcript followed by discipline, gender (M/F) and academic level in brackets. Note that 'A/Prof' in the Australian system is 'Associate Professor'. The views expressed in the findings are those of the research participants, not necessarily of the authors.

Perceived constraints in implementing undergraduate research experiences

The key constraints in spreading undergraduate research engagement were perceived to be specific institutional policies and structures, academics' mindsets and lack of skills, and questions of time and money. Participants also mentioned issues of academics' communication, general points about academic working conditions, and some also mentioned issues of student attitudes and competence.

Institutional structures perceived to constrain development

The commitment of the institution to undergraduate research at the highest policy level was considered important but needed to be supported by facilitative structures. Teaching and research were perceived as separate, and the development of undergraduate research

is not helped by the institutional focus on research. Also, the fact that there was no formalised or coordinated requirement for students to do research was considered a hindrance to its development. Further, large student classes were thought to mitigate the introduction of research-based learning. The ethics processes were regarded as confusing and bureaucratic.

Although several schemes for students to work on real research projects alongside academics existed at their university, they were uncoordinated. Interviewees pointed to duplication of administrative effort given that there was no organisational structure for undergraduate research, for example, no undergraduate research unit. Interviewees stated conflicting recruitment schemes meant students were not always well matched with allocated projects.

In addition, some academics pointed to the shortness of semester breaks in the Southern academic year. This meant there was not enough time for students to do research projects. This was compounded by the fact that external research facilities shut during January.

Perceived academic attitudes, skills and mindsets

A number of participants pointed to academic attitudes/mindsets and lack of knowledge or skills of how to implement research-based learning as key constraints. The need for professional development of academics was strongly stated and this included sessional staff. On the other hand, it was stated academics do not attend professional development meetings and there is 'academic arrogance' (13, 8, 20, 9).

Related to this was a lack of communication amongst staff in certain departments. Such 'departmental silos' (11, 6) meant that there was not an exchange of views about what was possible. Although some academics pointed to a lot of discussion between academics in their department which was considered enabling.

Academics' views of students and their capabilities to engage in research

Academics' views of students and what they are capable of was also considered by some to hinder development. Some participants said that students needed to see the relevance or to be convinced.

Some academics argued that undergraduates were not yet at the right level or did not like learning research skills. They pointed to a lack of skills and considered that research was not appropriate for students who are struggling academically or who do not have the right attitude to research from a health and safety perspective.

> So we can't offer this to all undergraduates … It's great for the bright ones and the well attuned ones and you can get them doing research but getting everybody in the undergraduate curriculum doing all sorts of stuff is virtually impossible I think. (15, 8, Science, M, Prof)

On a practical level, one participant said that there was no time in the curriculum for inquiry-based learning and that there was no culture of evidence-based practice in their department. Another pointed to the fact that new staff did not yet have a lab, and that it took time for research to grow.

Time, funding and resources

Another set of key constraints mentioned by most of the interviewees related to time, money and resources. This academic summed up the views of many:

> I see it as time and money and the fact is that the money is focused on higher degree research and the undergraduate research is not compensated financially. (20, 10, Science, F, A/Prof)

Workload formulae were perceived to be a particular problem for many academics. This was particularly so with the amount of time allocated for each student's assessment per semester. Implementing undergraduate research was considered to be labour-intensive, and sessional staff did not have time, inclination or knowledge. This issue is neatly summed up in the following quotation:

> one of the biggest challenges [is] the assessment policy that we're only assigned one hour and 20 minutes per student for the whole of the unit … And so if I'm doing the marking okay that is fine but if I'm … paying tutors I can't in all conscience ask them to do more than that cos that's what they're getting paid for. (16, 8, Hums, F, A/Prof)

Academics' definitions of undergraduate research

In the interviews it became clear that when academics talked about undergraduate research experiences, they were talking about different things. When asked to provide a definition of undergraduate research, some said undergraduate research referred to everything that students did at university, whereas others said it referred only to a specialised set of activities which were available only to a few students. Some academics focused on undergraduate research as being closely structured and guided whilst others said that students needed to be doing research independently. Some academics considered that if students were involved in various stages of the research process, for example, collecting data or engaging in bibliographical exercises, then they would call that undergraduate research but others considered that students had to be involved in the whole process of research from setting questions or hypotheses, designing experiments or data collection right through to reporting the findings in some kind of publication.

Another important distinction in undergraduate research conceptions was whether the focus was on skills development or on broader development including students' views of the role of research in their future lives. Academics also differed in their views of the quality of the research that students conducted. For some, student research was inevitably inferior; perhaps replicating existing research but not contributing to knowledge generation. For others, student research was real research which contributed to the generation of publishable new knowledge. Finally, some academics viewed undergraduate research within the confines of students' courses of study where students were treated merely as students, whereas for others undergraduate research was viewed as having a wider role in preparing future researchers where students were viewed as junior colleagues and treated as such. Although the language used in different disciplines varied, perhaps surprisingly, these definitional differences did not appear to reflect disciplinary differences. Responses are summarised in Figure 2. Implications are discussed below.

Span	Everything all students do	vs	A specialised process only for a few students
Guidance	Guided research (groups or individually)	vs	Independent research (groups or individually)
Process	Involvement in stages of research separately e.g. data collection	vs	Involvement in complete research process e.g. questions to write up and presentation
Focus	developing skills (doing)	vs	developing the student (being)
Quality	UGR is secondary, lower quality research – not publishable	vs	UGR is original publishable research generating new knowledge
Identity	Students' identities as researchers are limited to the degree and student cohort	vs	Undergraduate researchers treated as members of the research community and as future researchers.

Figure 2. Variations in academics' definitions of undergraduate research.

Forms of engagement in undergraduate research

It appeared that how academics defined undergraduate research determined what they thought was possible or desirable. A number of forms of engagement in undergraduate research were devised using data on definitions together with examples provided by interviewees (see Figure 3). These forms of engagement could map onto other schemas (e.g. Healey and Jenkins 2009), but as products of academics' definitions of undergraduate research, these forms show how academics view different practices. These forms differ in the kinds of activities that students engage in, how the activities are related to each other and in their implications for students' outcomes. Shading is used to differentiate three levels of engagement: undergraduate learning; atomistic approaches to undergraduate research development; and wholistic undergraduate research.

Each of these forms has different implications for the spread of research engagement across the undergraduate curriculum and in co-curricular activities. These are discussed later.

0 - Undergraduate learning

The perception of undergraduate research that everything students do at university is research, and is exemplified in the following quotations:

There's a built in assumption if we get you to write an essay on this topic … that the student is doing research. I mean we haven't been expected to spell that out. (6, 9, Linguistics, F, SL)

Every time [students] read a book and they are thinking about a question they are actually researching. So research is an activity that happens every hour of every day in universities … It's a way of thinking. (10, 4, Psychology, F, A/Prof)

UNDERGRADUATE LEARNING: Insufficient Undergraduate Research Development	ATOMISTIC UNDERGRADUATE RESEARCH DEVELOPMENT: Some recognition of need to develop undergraduate research skills but practice is patchy and coordination across programs requires more work			WHOLISTIC UNDERGRADUATE RESEARCH: Some good recognition of the need for coordinated development and integration of students into the scholarly community.	
0. Individual work	1. Individual uncoordinated skills development	2. individual & group coordinated skills development	3. Research-based scholarly experience/tasters	4. Scholarly practice within courses	5. Integration into the scholarly community
Within courses	Within courses	Within courses	Co-curricular engagement	Within courses	Co-curricular engagement
Students are treated as an audience for research. They may attend lectures on research methodology and are assessed through essays and/or reports.	Essays and reports are framed as research. Individual research techniques are practiced, e.g. bibliographical exercises, laboratory techniques, field work, etc.	Research techniques are combined and scaffolded through the curriculum. Specific techniques are practiced on unconnected topics.	Students work as research assistants, in internships or voluntarily on existing research projects alongside researchers.	Through a program based approach to course design, research skills and experiences are coordinated so students engage in whole research process.	Funded by scholarships, or internships, students work alongside researchers on individually tailored and owned projects engaging in whole research process from question setting to publishing.
Students develop basic student competency but are largely unaware of research and research opportunities.	Students develop academic skills, knowledge of some techniques but research in the university is unconnected and they are unaware of research and opportunities.	Students develop research techniques but lack understanding of relationship to chosen profession.	Students are introduced to research life and practices. May be paid a stipend or salary or may gain academic credit.	Students develop a disciplinary professional tool kit with a clear sense of the research process. They practise skills in a coordinated manner and know how research relates to profession.	Students are fully integrated into the scholarly community and treated as equal with academics. They know how their research furthers the discipline. May gain a stipend or academic credit.

Figure 3. Forms of engagement in undergraduate research.

These views lead to students being largely unaware of research and research opportunities. One interviewee, however, described this as basic student competency that cannot be called 'research', and we agree as arguably there is no or little scope for undergraduate research development here as academics consider students are doing it already as a matter of course. For this reason, we do not count this as a form of undergraduate research (hence the use of '0'). There may be lectures where students are an audience for academics to tell them about their own and others research. They may have lectures on research methodology and assessment through essays and/or reports. However, as the literature has shown (see e.g. Turner, Wuetherick, and Healey 2008), many students are unaware of research in universities.

1 - Individual work, study and uncoordinated skills development

In this first true form of undergraduate research, essays and reports are framed as research and linked to journal article writing. Students carry out bibliographical exercises and/or critical literature reviews and they practice individual research techniques, for example, laboratory techniques, data mining, field work, questionnaire design, etc. Students develop skills of academic writing and critical analysis. They develop knowledge of particular disciplinary techniques.

> Interviewer: So the students doing an essay – do you call that research?
> Respondent: Yeah I would call that research. If I tell them that … I want them to do research on debates about [topic] … then I expect them to do a lot of research looking at the history of [topic] … and so on. So that is going to involve figuring out what to read and how to construct an argument. So in that sense it is research. … We call it a research essay. (17, 5, Anthropology, F, A/Prof)

This form of engagement differs from the previous one in that an explicit link is made here between activities and research. Undergraduate research (UGR) is conceptualised as something all students do, but it is not everything they do. Although activities may appear unconnected with research in the university and professions, and students may be largely unaware of research and research opportunities, some attempt is made here to link to research activities, for example, writing academic articles.

2 - Coordinated skills development through individual and group work

In the second form, research techniques are combined and scaffolded throughout the curriculum. Students are involved in the different stages of research. They learn how to set hypotheses, generate questions, collect data, write reports and engage in disciplinary techniques and so on, but these may be practised on unconnected topics. The focus is on research skills development, but students are unlikely to develop understanding of how the research they are doing relates to their chosen profession nor life afterwards.

> I think it is any learning activity or content that has some focus or element of research to it. So … students could … interview each other to learn about interviewing. … . I used to try and get them aware of a range of methods or give the class a set of data and then have them in groups interpret it using different approaches. … More actively … we could use the whole class … get everybody to fill something in and then collectively collate that data and see what we would do to it, we've done that. … I've had them go out and interview or survey in the community and bring those results together. … So there's endless possibilities. (13, 5, Education, F, SL)

It is that skills development in the scientific research method that's important … and that's what I define as the research component of it. So they're constantly developing research skills, analytical thinking, being able to think about what data mean and interpreting it. … For me undergraduate research is developing that critical analysis skill set that they need. (14, 6, Geology, M, A/Prof)

3 - Research-based scholarly experience/tasters

Here, students are involved in data collection or analysis in existing research projects working alongside staff, Ph.Ds, post docs, etc. They may work as research assistants and/or as part of a scholarship scheme, or projects set up by academics. Students are typically paid a stipend or salary, or they may gain academic credit. Engagement may be voluntary.

> Some labs are more accessible for undergraduate stuff than others. But for example my research group have had two undergraduate interns this year. … [they] carried out field work with me and a PhD student of mine and spent considerable periods of time actually in the field learning how to capture, in this case [animal] and how to mark them and measure them and carry out population surveys. … It wasn't necessarily designed to integrate with any particular knowledge base they might have developed as part of the undergraduate [course] … [It's] completely independent of that. (9, 5–6, Biology, M, A/Prof)

This form of engagement is still atomistic because, although students are introduced to research life and practices of scholarly engagement, the work is unconnected to their learning in courses.

4 - Scholarly practice within courses

As we move to more wholistic undergraduate research, a programme-based approach to the design of courses can ensure students acquire a coordinated set of research skills and experiences. Students develop their disciplinary 'professional tool kit'. Students devise questions or hypotheses, set up experiments, or carry out fieldwork to answer them, collect the data, analyse it and report on the findings. The curriculum structure enables them to gain a clear sense of the process of research in the discipline. They can practice skills needed and they know how research relates to their chosen profession and life afterwards. The focus is on developing the student as researcher.

> Undergraduate research in order for it to be defined as research has to have [a] trajectory that takes them on the path of what … that involves. So formulation of the question, figuring out how to answer it, going out and interviewing people or … whatever … and then analysing it and then writing it in a presentable form. … So that trajectory I think that's what research is for me. You can do parts of research you can teach methodology, but you're not teaching research if you just do methodology so you need the beginning to the end. (19, 5–6, Anthropology, M, SL)

5 - Integration into the scholarly community

Opportunities for student to work alongside academics on individually tailored research projects were viewed by some academics in our study to be the only way undergraduate students can engage in research. Students in this conception engage in the whole

process. They devise questions or hypotheses, set up experiments, carry out fieldwork, collect the data, analyse it and publish the findings. Engagement may be as summer or winter vacation scholarships, or internships. Students are typically paid a stipend or may gain academic credit. They are fully integrated into the scholarly community, are treated as equals with academic researchers and have ownership of particular projects. They know how the research they are doing furthers the discipline. Their research generates new knowledge that is publishable.

> I would characterise it as students actually doing genuine research which in some cases could be publishable in a journal. Having a student be able to get a scholarship to do this is helpful. … So there needs to be some sort of framework to fit them in. … And having post docs and PhD students who can in their lab mentor the more junior people … can be very helpful. … And that extra help from the broader group of researchers … is an important part. So the undergraduate feels they're fitting into a broader team or group. (15, 6–7, Geology, M, Prof)

Academics recognised that this is likely to be a costly process only available to a few select students.

Discussion

The different definitions of undergraduate research given by academics in this study appeared to lead to different forms of undergraduate research being implemented. Some definitions appeared to open up opportunities for development while others appeared to limit it.

At each extreme, development is difficult. For example, if everything students already do is considered to be research, then it will be assumed that the university's aims in undergraduate research have already been met, and there is no need to do anything different. On the other hand, integration into the scholarly community is resource-intensive and only likely to be available to very few students. So without extra resources, development at this level is limited.

It is noticeable that some definitions of undergraduate research found in this study are based upon preconceived ideas that students are incapable of research. These ideas to some extent are tied to academics' definitions of undergraduate research. Given that school children are recognised as being capable of doing (sometimes publishable) research (see e.g. Kellett, Forrest, Dent and Ward 2004; Steinberg and Kincheloe 1998) these ideas need to be challenged. Indeed, opening up mindsets (both staff and students) to new possibilities is essential if universities are to achieve aspirations to develop undergraduate research. For example, a range of opportunities for engaging in both guided research and independent research, involving students both in the stages of research and in the complete research process need to be fostered, possibly at different levels. It may be that atomistic undergraduate research development is appropriate in the early years (Nos. 1, 2 and 3). Students then may move to more wholistic development in third year; that is, to forms of scholarly practice within courses (No. 4), with an increasing number of students gaining experience of integration into the scholarly community (No. 5). Accepting that there may be occasions when students are engaging in lower level research in order to learn, and other occasions when they are engaging in generating new knowledge is also indicated. And while there are times when a focus on skills is appropriate, ways need to be found to encourage in

students' researcherly attitudes and behaviours, and for them to know that these are relevant in whatever profession they undertake.

We looked at whether the different ways of defining undergraduate research were related to discipline and found examples of each of the forms in sciences, social sciences and humanities. Discussion in specific departments could provide a mechanism for changing mindsets. In this study, academics pointed to the need to develop staff confidence. They suggested that opportunities for professional learning and knowing what they can do is facilitative, that is, one-to-one specific help working alongside staff, workshops and showcases, as well as having accessible resources for staff. Faculty pilot projects were also suggested as helpful. In addition, having course conveners who enjoy research, and staff educated in the USA who were formerly undergraduate researchers themselves, were mentioned by our interviewees as helpful.

The study was of course limited in that it only focused on the views of academics in one institution, and it only included people who were in favour of undergraduate research. Nevertheless, the findings suggest that there is considerable scope for development providing that academics' understandings of undergraduate research are challenged. Departments may find the forms of engagement useful in characterising current practice and facilitating progress through audit and review. Some of the suggestions that our interviewees regard as enabling may assist this process.

What is facilitative of undergraduate research development: what works?

A culture of undergraduate research and inquiry

What academics thought was needed was a culture where undergraduate research is seen as normal. It is important to grow a culture of evidence-based practice, and philosophy of research-based teaching. Research needs to be seen as a living thing.

> I think communication is the main thing from where I sit in this department … that research is something that happens in universities. It is research that the educational opportunity you're getting here is built on ultimately and that research is a living thing … And that you can be doing research and you can be engaging with it very early on. (7, 10, History, M, SL)

Having a supportive head of department or significant senior person also helped but it was pointed out that this person need not be current but may have begun a history of UGR implementation in the past which has carried on. Funding, even small amounts, were also perceived to be facilitative.

University policies, procedures and structures

University policies can be used to facilitate development of undergraduate research experiences: for example, requiring new course proposals to include research experiences and outcomes; simplifying ethics requirements for low-risk coursework research, and one participant mentioned the idea of having research-led teaching associate deans in faculties so that they can integrate research and teaching strategy. Some interviewees indicated that the course review process provided useful mechanisms for introducing ideas.

Facilitative structures for encouraging undergraduate research mentioned in this study included: a programme-based approach to course development; also three-hour 'lecture

slots', and the idea of the 'flipped' classroom were thought to provide time for inquiry-based activities during class time. Other suggestions included embedding inquiry as part of induction, providing maps of what has been done or a structure for scaffolding research within units. The working group on undergraduate research had been useful in spreading ideas, as had an undergraduate research newsletter and undergraduate research conferences. Some academics had set up research internship programmes, one had worked to encourage staff to overcome hesitancy over ethics applications, and yet another was trying to influence policy.

A coordinated system for undergraduate research internship programmes including a formal structure for applying for grants and a coordinated approach for the allocation of undergraduate scholars were considered important. One participant suggested that if a course with some element of inquiry was counted as workload this would encourage staff.

Academic engagement

Multiple opportunities for professional learning for academics and sessional staff including sharing good practice, encouraging discussion and providing resources to support this were also suggested as facilitative in this study. As mentioned above, discussion amongst academics was a key facilitator in encouraging the spread of ideas about undergraduate research and inquiry, and some interviewees indicated that they encouraged such talk in their department.

Interviewees themselves used a number of strategies for encouraging others. These ranged from opportunistic 'badgering' (10, 5; 13, 5) to taking a multi-pronged approach providing examples, talking to colleagues about what staff are doing, or what is possible, modelling good practice and encouraging academics to put forward projects in funded schemes.

Other suggestions included providing resources for academics to fit undergraduate research into their own research programmes. Ensuring there were tangible outcomes, that is, publication and encouraging applications for research grants to include undergraduate scholars were also mentioned as enabling. Interviewees suggested that the university should develop a system of rewards for academics who integrate research into their courses. These might be financial or workload related. Scientists mentioned having research labs, post docs and Ph.D. students mentoring undergraduates as helpful.

Student engagement

Despite some negative views of students' capability and interest in engaging in undergraduate research amongst some academics, others said that students were positive, have an aptitude for research and want to learn. They indicated that exemplars for undergraduate research where students can gain academic credit need to be provided.

Other interviewees mentioned their efforts to spread ideas amongst students, for example, setting up research projects, providing support for student societies such as the Biology Student Society (9, 6) and the university undergraduate research student society, and through actively encouraging students' attendance at undergraduate research conferences.

Conclusion

This paper has brought to the fore, the challenges and barriers to implementing research-based experiences for students as perceived by academics at a large research-intensive university in Australia. The interview study has also surfaced aspects that academics consider facilitative of change. We hope the suggestions in this paper can be used to assist in the development of these aspirations and that by building on the elements mentioned, universities can develop effective workable strategies to enhance students' experiences of research across the whole institution. In this regard, we end with a quotation about the benefits to students from one of the interviews:

> The students are so engaged when they're doing their own research, they're just on fire and interested in a way that they aren't when they're just reading about the research that other people do. They're so interested and they learn more, they learn … from every part of the research project including failure. You know they fail, they make mistakes, they have problems, things don't go well and they learn from that. It is just an incredible process and you see how turned on they get when they're doing their own research projects. And that's why I make all the effort that I do to make it happen in the classes that I teach because I see this degree of engagement that's just beyond what you see when you're just teaching them about other people's research. (17, 8–9, Anthropology, F, A/Prof)

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

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