The role of academic developers in embedding high-impact undergraduate research and inquiry in mainstream higher education: Twenty years' reflection

Mick Healey[a] and Alan Jenkins[b]

[a]Healey HE Consultants, Howden, UK and Emeritus Professor, University of Gloucestershire, Cheltenham, UK; [b]Emeritus Professor, Oxford Brookes University, Oxford, UK

CONTACT Mick Healey (mhealey@glos.ac.uk)

Notes on contributors
Mick Healey is Managing Director of Healey HE Consultants and an Emeritus Professor, University of Gloucestershire. http://mickhealey.co.uk/

Alan Jenkins is an Emeritus Professor, Oxford Brookes University. http://alanjenkins.info/

Acknowledgements
Angela Brew (Macquarie), Rachel Spronken-Smith (Otago), Nancy Turner (Saskatchewan), and Helen Walkington (Oxford Brookes) provided helpful and insightful comments on a draft of this article.

ABSTRACT
The focus of this article is on the role of academic developers in supporting and influencing undergraduate research and inquiry, a high-impact activity. We examine the levels at which academic developers can influence undergraduate research and inquiry practices by distinguishing between staff and student practices; disciplinary and departmental practices and policies; institutional practices and policies; and national and international practices and policies. Drawing on our experiences over the last 20 years, we discuss the widening of academic development practice and consider who are the academic developers when it comes to embedding undergraduate research and inquiry in mainstream higher education.

KEYWORDS
Academic developers; academic development; undergraduate research and inquiry

> *'All* undergraduate students in *all* higher education institutions should experience learning through, and about, research and inquiry.' (Healey & Jenkins, 2009, p. 3)

> 'Academic developers … have a key role to play in fostering undergraduate research and inquiry within university curricula, in auditing and building upon current practice, and in raising teaching and learning issues within undergraduate research experience programs outside of the curriculum.' (Brew & Jewell, 2012, p. 56)

Introduction

In this article, we reflect on our experiences over the last two decades to draw out the varied and changing roles that academic developers have played in endeavouring to embed undergraduate research and inquiry within the 'mainstream' i.e. as a core feature of the undergraduate curriculum. In this period, undergraduate research has grown from its US origins, mainly in the laboratory sciences for selected students, to an international movement across a wide range of disciplines and institutions and reaching out to a wide range of students (Healey & Jenkins, 2009; Shanahan et al., 2015). Our perspective is as two geographers, who both moved into academic development in the latter part of their careers, who have had the privilege of visiting many institutions in different parts of the world to examine how they support undergraduate research and inquiry.

In the conclusion, we argue that many of the initiatives to embed undergraduate research and inquiry in the curriculum raise questions of what we now, and in the future, conceive of as 'academic development' and the role of 'academic developers'.

High-impact undergraduate research and inquiry

Kuh (2008) identified 10 high-impact activities to increase student engagement and success to which he later added an 11th (Kuh, 2017). Five of these may involve engaging students in a variety of ways in research and inquiry (first year seminars; collaborative assignments; undergraduate research; service learning; capstone courses). The challenge is to make these high-impact practices potentially available for all students and not only for those in small institutions, where small classes predominate, or at a small scale in large institutions (Jenkins et al., 2007; Kuh & O'Donnell, 2011).

Broadly speaking there are two main approaches to engaging undergraduate students in research and inquiry (Healey & Jenkins, 2009; Zimbardi & Myatt, 2014). First, there is the elite model in which selected students are invited to participate in staff-conducted or staff-mentored research,

often outside the curriculum. The second approach is the mainstreaming model, in which opportunities to engage students in research and inquiry are embedded in the curriculum. They are complementary approaches and many institutions have developed strategies for the implementation of both models. Here we focus on the second approach.

Clearly the opportunities and constraints to mainstream undergraduate research and inquiry vary between research-intensive institutions, less research-intensive institutions, and college based higher education providers, and between small and large institutions.

Our experience of collecting several hundred case studies of ways of engaging students in research and inquiry is that there is greater variation in practice *within* institutions and institutional types than there is *between* them. With appropriate adaption, most practices are transferable across a wide range of institutions (Healey & Jenkins, 2009; Healey, Jenkins & Lea, 2014). However, we recognise that examples from similar types of institution are, at least initially, perceived as more accessible to readers and workshop participants than ones from different types of institution.

Building on the work of Griffiths (2005) we make a distinction between four overlapping ways in which students may engage with research: *research-led,* where students learn about current disciplinary research; *research-oriented,* where they develop research skills; *research-based,* where the focus is on undertaking research; and *research-tutored,* where they engage in discussions on current research (Healey, 2005; Healey & Jenkins, 2009). This framework has been widely adopted to support individual academics, course teams, and institutions to plan ways in which they can strengthen how students can learn through and about research. The key decision is identifying the appropriate balance between the four approaches. This will vary by discipline, student background, course level, and type of institution.

The 'elephant in the room' in most discussions about engaging students in research and inquiry is what is meant by these terms. Our experience is that participants in workshops often begin with talk at cross-purposes and mean different things by these terms. According to the Council on Undergraduate Research (CUR) undergraduate research is 'An inquiry or investigation conducted by an **undergraduate** student that makes an original intellectual or creative contribution to the discipline' (nd). Levy (2011) makes a useful distinction between students participating in building knowledge, where the findings are new to society, and students exploring and acquiring existing knowledge, where the findings and the experience of learning through and about research are new to the students. If the first meaning is adopted, then undergraduate research and inquiry may be seen as only appropriate for selected students and mainly seniors; though our experience is that given suitable support and encouragement many more students, and at an earlier stage in their courses, can be engaged in discovery activities, than many staff initially think is possible. If the broader second meaning is accepted, then it is possible for all students to be engaged in learning through research and inquiry. Discussion of such issues at course team and institutional levels is a way to try to create a broad consensus of understandings of teaching and research relations and shape effective curricula interventions. Such discussions may result in the institution developing its own understanding of what is meant by 'linking teaching and research' and 'undergraduate research'; and with this consensus, move towards embedding practices across an institution. Brew and Mantai (2017) found that such conversations are critical to developing undergraduate research engagement.

Academic developers and academic development

In a previous issue of the *International Journal for Academic Development*, Brew and Jewell (2012) identify nine ways in which academic developers may support undergraduate research and inquiry (Table 1).

Table 1.

This schema begins to point to the ways that over the past twenty or so years academic development has widened from a nigh exclusive focus on teaching and assessment guidance (particularly for new staff) to seeking to shape overall academic practices and policies from the level of the individual to institutional and even national levels (Gibbs, 2013). Undergraduate research has the potential to challenge the firewalls between teaching and research and the frequent structural separations between departmental, institutional, and national teaching and research committees and policies. While this provides rich opportunities for academic developers to enhance and influence practice and policy, it also highlights that they need to decide and act on where they can make the most significant impact.

Here we use the *level* at which academic developers may support and influence the mainstreaming of undergraduate research and inquiry to distinguish between staff and student practices; disciplinary and departmental practices and policies; institutional practices and policies; and national and international practices and policies (Figure 1). Whereas there are numerous Individual courses, modules and units that are research-based, and many whole programmes where course teams have thought through what progression in research-based education means, there are only a few examples that we know of where research-based education has been strategically embedded across most, or all, of the institution.

Figure 1.

Academic developers and staff and student practices

From our experience of running numerous workshops for staff in many different countries on mainstreaming undergraduate research and inquiry, the two things participants appreciate most are, first, the selected mini-case studies we present on how other staff do this in different disciplines, programmes, institutions, and countries (see http://www.mickhealey.co.uk/resources); and, secondly, discussing with their colleagues how the ideas presented may be adapted to their context. Both activities help to build confidence to choose from the wide range of practical ways of engaging students in research and inquiry, and to develop the skills needed to implement them. Other workshop activities which participants find helpful include working through various models and schemas for engaging students as researchers, such as the research skills development framework (Willison & O'Regan, 2007), the dimensions of undergraduate research model (Beckham & Hensel, 2009; Walkington, 2016), the framework for promoting dissemination of undergraduate research and inquiry (Spronken-Smith, et al., 2013), the framework for curricular and pedagogical decision-making (Brew, 2013), the levels of student participation in research model (Walkington, 2015), as well as our curriculum design and the research-teaching nexus model (Healey, 2005; Healey and Jenkins, 2009). A set of strategies which academic developers may promote to support staff who teach through student research and inquiry are shown in Table 2.

Table 2.

A key role for academic developers supporting staff is to assist them in their roles as mentors, supervisors, facilitators, and co-researchers (Shanahan et al., 2015). These roles are discussed in depth in other articles in this Issue. An important argument here is that:

> 'As the significant benefits of mentored scholarly experiences continue to be uncovered, the years ahead promise continued growth and innovation in what has traditionally been known as

"undergraduate research." This research suggests that the next decade may bring further *democratization* of UR.' (Shanahan et al., 2017, p. 4, emphasis added)

Academic developers traditionally are staff-facing and have little directly to do with undergraduate students, apart from in their roles on various teaching and learning committees. However, with the growth of interest in 'students as partners', a growing role for academic developers is facilitating students and staff to work together (Cook-Sather, Bovill & Felten, 2014; Healey, Bovill & Jenkins, 2015). This is linked to the concept of 'student as producer' (Neary, 2014). Engaging students in subject-based research and inquiry is one of four overlapping areas that students may engage as partners in learning and teaching in higher education (Healey, Flint & Harrington, 2014).

Critical here is to convince students and staff that engaging students in research and inquiry is not just for high-flying students who may be considering a research career. As Brew succinctly states:

'For the students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidence, take decisions on a rational basis, and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.' (Brew, 2007, p. 7)

Brew, Mantai & Miles (in submission) draw attention to the ways in which academic developers can work with students to raise their interest in and awareness of undergraduate research opportunities, for example through social media. They also suggest how developers can encourage students to take initiatives, such as organising undergraduate conferences.

Academic developers, disciplinary and departmental practices and policies

Coate et al., in a study of departmental organisation in the UK, showed that departmental managers found that: 'it is more convenient for teaching and research activities to be treated as separate activities. On an academic level, however, managers would rather perceive the two to be synergistic.' (2001, p. 162)

Much of the early development of undergraduate research, at least in the United States, was in the STEM disciplines. Over the past two decades there has been much scholarly discussion of the effective forms of student research and inquiry across a variety of disciplines (Jenkins et al., 2007; Healey & Jenkins, 2009; Shanahan et al., 2015). It is our experience that when inviting staff to consider how to integrate student research into their courses it is generally more effective to start by discussing the forms of research in their discipline and then move to exploring how the forms of undergraduate research and disciplinary case studies from other disciplines can be adapted to the teaching in the staff members' discipline and departmental context (Healey & Jenkins, 2003).

Such discipline-based interventions also raise issues of departmental policies, for it is generally in departments that staff roles are defined and where courses are organized. Roxå & Mårtensson (2015) emphasise the importance of academic developers understanding such micro-cultures. Our experience is that academic developers often have the greatest impact by working alongside disciplinary course teams and departmental managers to create effective teaching-research linkages. Moreover, academic developers can use their cross-institutional knowledge to broker inter- and multidisciplinary research partnerships and projects.

While early research, such as work by Coate et al. (2001), revealed how often departmental policies treated teaching and research as separate activities, over the past twenty years, guided by

research on department policies (e.g., Durning & Jenkins, 2005), there has been a growing understanding of how to shape effective teaching-research links to benefit both students and staff. Table 3 presents one such schema to guide academic developers wishing to influence course teams and departmental managers.

Table 3.

Three other resources which academic developers may find useful are provided, firstly by Fung (2017, pp. 146-147), as a list of 20 questions for implementing a connected curriculum centred on research-based education; secondly, by CUR (2012), as a discussion of the characteristics of excellence in undergraduate research; and thirdly, by Shanahan et al. (2015), as 10 salient practices of undergraduate research mentors.

Academic developers and institutional practices and policies

Many institutions claim in their mission statements, strategies, and websites that their curriculum is research-based. Twenty years ago, there was a major gap between the rhetoric and the reality, as is illustrated in this extract from a quality review of a UK research intensive university.

> 'The University's account argues strongly for the continuing and crucial value of the link between teaching and research … In practice … the audit team found that there was very little systematic reflection within the University about just what was meant by the claimed interdependence of research and teaching.' (Higher Education Quality Council (HEQC) 1997, p. 3).

Internationally it has long been a widespread assumption that undergraduate students benefit from the research culture of universities. However, it is now clear that many of the assumed benefits were at best achieved through tacit practice and were not supported through embedded institutional policies. Certainly, as we started to work with institutions to try to shape the practice of individual academics and course teams, developing effective teaching-research links were hindered by institutional policies for teaching and research which failed to address such issues. While often the institutional research policies and teaching policies proclaimed teaching and research links, the effective strategies ignored such issues, and particularly in their promotion policies, often in effect created 'firewalls' between teaching and research and devalued the role of teaching. However, over the past twenty years the growing understanding of these issues has begun to shape effective institutional policy interventions. These have largely been through institutional *teaching* policies, but there are now a range of institutions that have developed innovative and effective 'comprehensive' strategies that promote undergraduate research and inquiry (Table 4). Nevertheless, though growing, the total number of institutions which have developed effective strategic approaches to mainstreaming research-based curricula, which have been embedded across most of, or all, of the institution, is still small.

Table 4.

From examining these and other examples of institutional embedding practices and policies we created a typology of institutional approaches to mainstreaming research and inquiry (Healey and Jenkins, 2009, pp. 80-81). From this wider framework we identify here those activities academic developers may find relevant to their institutional context (Table 5).

Table 5.

In presenting this typology we recognize that the combination of appropriate strategies will vary between institutions and national systems. The central message here is for academic developers to

be aware of the range of possible strategies and then decide which to prioritise, given their local context. As Brew and Cahir (2013) argue, based on their study of two Australian universities, academic developers seeking to embed undergraduate research need to recognize this is a long-term process and that institutional and national priorities will change. Hence it may be necessary to reshape the form of undergraduate research promoted to reflect such changing priorities.

Academic developers and national and international practices and policies

> 'the only kind of impact excluded from the forthcoming REF is the impact on student learning in the department and institution where the research takes place.' (Brown, 2010)

In many national systems funding for teaching and research is separated. Indeed, in Canada and the US the former is largely a Provincial/State responsibility and the latter a Federal one. Furthermore, internationally research funding has increasingly been concentrated in research-intensive universities. This poses severe barriers to effective teaching-research links in institutional policies. Yet while there are strong reasons for research funding to be concentrated, national strategies can positively impact students' learning through conducting research (Table 6). For example, in the 1990s the National Science Foundation (NSF) reviewed all its grant procedures to ensure undergraduate and postgraduate students were included in funded research projects. They later developed a range of initiatives to develop undergraduate research throughout US higher education (NSF, 2006).

Table 6.

National research policies can also lead to the exclusion of undergraduate students from the research cultures of the universities. For example, in 2006-7 the UK research assessment exercise was modified to give greater emphasis to research dissemination. The Research and Teaching Forum brought together academic developers, institutional leaders, and international research and policy makers to enhance understanding and practice of effective teaching research links (D'Andrea, 2016). The Forum welcomed the emphasis on dissemination and proposed that 'the impact on student learning should be a major criterion in future assessments' (Research and Teaching Forum, 2006; Jenkins & Healey, 2016). Unfortunately, the proposal was rejected. However, the work of the Forum resulted in a meeting with the UK Minister for Education. This led to the Higher Education Funding Council for England (HEFCE) allocating £40 million to institutions to develop research-informed teaching environments with funds allocated inversely proportional to an institution's research funding (Jenkins & Healey, 2016). Sometimes lobbying by academic developers and others is unsuccessful, while on other occasions it can be influential.

Persistence can bring rewards, as can the evidence of national systems revising their research funding following the lead of the NSF to support teaching-research links. Proposed revisions to the UK research excellence framework for 2021 include:

Commented [HM(1]: Put in full first time used above

> 'The guidance on submitting impacts on teaching will be widened to include impacts within, as well as beyond, the submitting institution. We will also work with the panels to develop appropriate guidance on demonstrating evidence against the criteria for this type of impact.' (HEFCE 2017, p. 7)

This offers opportunities for academic developers in the UK to develop further effective teaching-research links and impacts.

Conclusion

'The most important obligation now confronting the nation's colleges and universities is to break out of the tired old teaching versus research debate and define, in more creative ways, what it means to be a scholar.' (Boyer 1990, p. X11)

In the early 2000s we participated in conferences in the USA which focused on how Ernest Boyer's (1990) *Scholarship Reconsidered* had impacted US higher education. A central theme was the number of institutions that had created or expanded undergraduate research programmes. We then investigated a range of such programmes and met with leaders of the NSF and CUR. We took away the strong conviction that such initiatives provided intellectual and practical ways to enhance undergraduate education and more effectively link the research and teaching roles of the university.

Commented [HM(2]: Put in full first time used above

Over the last couple of decades, the work of Boyer and other scholars and researchers has transformed international understandings of teaching-research relations and the potential of undergraduate research and inquiry to enhance undergraduate education. Undergraduate research, once almost solely associated with US higher education, is now recognised as 'an international movement' (Jenkins & Healey, 2010, p. 41) as reflected in the series of international articles published in the *CUR Quarterly* (http://www.cur.org/documents/?CategoryId=7).

Academic developers have been centrally involved in this scholarly and policy work, but such developments have in effect transformed the role of academic developers and present both opportunities and challenges for their future roles and activities. As Brew argues 'there is a need for academic developers to reassess their relationship to research, and… research has to come centre stage in the practice of staff, educational and/or academic development' (2002, p. 112). The old model of educational development that largely focused on enhancing teaching practice – valuable as that role is – now needs to be seen as but part of the complex ways that universities need to enhance academic practice. It also raises questions as to what we now mean by academic development and who are academic developers.

Baume and Popovic suggest that the overall purpose for academic development is 'to lead and support the improvement of student learning' (2016, p. 1). The developments reviewed in this article show how mainstreaming undergraduate research and inquiry can enhance undergraduate education. Academic developers have played key roles in initiating and supporting these efforts, but so have some disciplinary course leaders, national/international disciplinary organisations, and institutional and national leaders. While they might not have a formal title as 'academic developers', they are in effect key agents in leading and supporting the improvement of student learning. If this argument is accepted, then it raises questions of what we now, and in the future, conceive of as academic development and the role of academic developers.

As Nancy Turner reflected on an earlier draft of this paper:

> 'Given the multifaceted aspects of this work at varying levels of higher education it begs the question, "who is an academic developer?" …The power of academic development work is capitalized when it is pervasive, rather than isolated in nature; when it happens across the higher education sector in varying ways; and when students, course leaders, teachers, vice chancellors, presidents and funding bodies work to influence at all levels alongside those in formal academic roles. *In this way, academic development could be conceived of as a shared activity, not a title; as a verb, not a noun.'* (Turner, 2017, emphasis added)

We agree. The next twenty years of academic developers embedding research and inquiry in mainstream higher education will require us to widen what and who are seen as 'academic

developers' and the ways 'we' work across our institutions to impact student learning and academic careers positively.

References

Andersen, A.S., Wulf-Andersen, T., & Heilesen, S.B. (2015). The evolution of the Roskilde Model, Denmark. *CUR Quarterly, 36*(2), 22-27. http://www.cur.org/download.aspx?id=3281

Bastiaens, E., van Tilburg, J., & van Merriënboer, J. (Eds.) (2016). *Research-based learning case studies from Maastricht University*. Dordrecht: Springer.

Baume, D., & Popovic, C. (2016). Introduction - some issues in academic development. In D. Baume & C. Popovic (Eds.) *Advancing practice in academic development* (pp. 1-16). London: Routledge.

Boyer, E.L. (1990). *Scholarship reconsidered: Priorities of the professoriate*. Princeton University NJ: Carnegie Foundation for the Advancement of Teaching. depts.washington.edu/gs630/Spring/Boyer.pdf

Boyer Commission on Educating Undergraduates in the Research University (1998). *Reinventing undergraduate education: A blueprint for America's research universities*. Stony Brook: State University of New York at Stony Brook. http://www.umass.edu/research/system/files/boyer_fromRussell.pdf

Brew, A. (2002). Research and the academic developer: A new agenda. *International Journal for Academic Development, 7*(2), 112-122.

Brew, A. (2007). Research and teaching from the students' perspective, *International policies and practices for academic enquiry: An international colloquium* held at Marwell conference centre, Winchester, UK, 19–21 April.

Brew, A. (2013). Understanding the scope of undergraduate research: a framework for curricular and pedagogical decision-making**.** *Higher Education, 66*, 603-618.

Brew, A., & Cahir, J. (2014). Achieving sustainability in learning and teaching initiatives. *International Journal for Academic Development, 19*(4), 341-352.

Brew, A., & Jewell, E. (2012). Enhancing quality learning through experiences of research-based learning: Implications for academic development. *International Journal for Academic Development, 17*(1), 47-58.

Brew, A., & Mantai, L. (2017). Academics' perceptions of the challenges and barriers to implementing research-based experiences for undergraduates. *Teaching in Higher Education, 22*(5), 551-568.

Brew, A., Mantai, L., & Miles, A. (in submission). Towards inclusive knowledge-building communities: An Australian university case study/example.

Brown, R. (2010). The only impact worth having. *Times Higher Education* 22 April. http://www.timeshighereducation.co.uk/comment/letters/only-impact-worth-having/411339.article

Cook-Sather, A., Bovill, C., & Felten, P. (2014). *Engaging students as partners in teaching & learning: A guide for faculty.* San Francisco: Jossey-Bass.

Crawford, K., Horsley, R., Hagyard, A., & Derricot, D. (2015). *Pedagogies of partnership: What works?* York: Higher Education Academy. https://www.heacademy.ac.uk/resource/pedagogies-partnership-what-works

CUR (nd). About the Council on Undergraduate Research. http://www.cur.org/about_cur/

CUR (2012). *Characteristics of excellence in undergraduate research (COEUR).* Washington DC: CUR. http://www.cur.org/assets/1/23/COEUR_final.pdf

D'Andrea, V. (2016). Engaging the international scholarly and policy community through active dialogue on the research-teaching nexus. In P. John & J. Fanghanel (Eds.) *Dimensions of marketization in higher education* (pp. 175-185). London: Routledge.

Deike, W., Gess, C. & Rue, J. (2014). Increasing students' research interests through research-based learning at Humboldt University. *CUR Quarterly, 35*(1), 27-33. http://www.cur.org/download.aspx?id=3064

Durning, B. & Jenkins, A. (2005). Teaching/research relations in departments: the perspectives of built environment academics. *Studies in Higher Education, 30*(4), 407-426.

Fung, D. (2017). *A connected curriculum for higher education*. London, UCL Press. http://discovery.ucl.ac.uk/1558776/1/A-Connected-Curriculum-for-Higher-Education.pdf

Gibbs, G. (2013). Reflections on the changing nature of educational development. *International Journal for Academic Development, 18*(1), 4-14.

Griffiths, R. (2004). Knowledge production and the research-teaching nexus: the case of the built environment disciplines. *Studies in Higher Education, 29*(6), 709-726

Healey, M. (2005). Linking research and teaching exploring disciplinary spaces and the role of inquiry-based learning. In R. Barnett (Ed.) *Reshaping the university: new relationships between research, scholarship and teaching* (pp. 30-42). Maidenhead: McGraw-Hill/Open University Press.

Healey, M., Bovill, C., & Jenkins, A. (2015). Students as partners in learning. In J. Lea (Ed.) *Enhancing learning and teaching in higher education: Engaging with the dimensions of practice* (pp. 141-163). Maidenhead: McGraw Hill, Open University Press.

Healey, M., Flint, A., & Harrington, K. (2014). *Engagement through partnership: students as partners in learning and teaching in higher education.* York: Higher Education Academy https://www.heacademy.ac.uk/engagement-through-partnership-students-partners-learning-and-teaching-higher-education

Healey, M., & Jenkins, A. (2003). Discipline-based educational development. In H. Eggins & R. Macdonald (Eds.) *The scholarship of academic development* (pp. 47-57). Milton Keynes: Open University Press.

Healey, M., & Jenkins, A. (2009). *Developing undergraduate research and inquiry*. York: Higher Education Academy. https://www.heacademy.ac.uk/node/3146

Healey, M., Jenkins, A., & Lea, J. (2014). *Developing research-based curricula in college-based higher education.* York: Higher Education Academy. https://www.heacademy.ac.uk/resources/detail/heinfe/Developing_research-based_curricula_in_CBHE

HEFCE (2017). Initial decisions on the research excellence framework. http://www.hefce.ac.uk/pubs/rereports/year/2017/ref201701/

Helfand, D. (2016). Mucking abut in the mess: Research-based education at Quest University Canada, *CUR Quarterly, 36*(3), 28-33. http://www.cur.org/DOWNLOAD.ASPX?ID=3282

HEQC (1997). *Academic quality audit: The University of Exeter*. London: HEQC.

Hodge, D.C., Nadler, M.K., Shore, C., & Taylor, B.A.P. (2011). Institutionalizing large-scale curricular change: The Top 25 project at Miami University. *Change, 43*(5), 28-35.

Jenkins, A. & Healey, M. (2010). Undergraduate research and international initiatives to link teaching and research. *CUR Quarterly, 30*(2), 36-42. http://www.cur.org/quarterly/mar10/spring10jenkins.pdf

Jenkins, A., & Healey, M. (2015). International perspectives on strategies to support faculty who teach students via research and inquiry. *CUR Quarterly, 35*(4), 31-37. http://www.cur.org/download.aspx?id=3147

Jenkins, A., & Healey, M. (2016). Reshaping understandings, practices and policies to enhance the links between teaching and research. In P. John and J. Fanghanel (Eds.) *Dimensions of marketization in higher education* (pp. 164-174). London: Routledge.

Jenkins, A., Healey, M., & Zetter, R. (2007). *Linking teaching and research in departments and disciplines.* York: Higher Education Academy. https://www.heacademy.ac.uk/node/3890

Kearns S.E., Miller, R.K., & Kerns, D.V. (2004). Designing from a blank slate: the development of the initial Olin College Curriculum. In *Educating the Engineer of 2020: Adapting Engineering Education*

to the New Century (pp. 98-113). Washington, DC: The National Academies Press. https://download.nap.edu/catalog.php?record_id=11338

Knapper, C.K. (Ed.) (2007). *Experiences with inquiry learning: Proceedings of a symposium at McMaster University 1-3 October 2004*. Hamilton, Ontario: McMaster University, Centre for Leadership in Learning.

Kuh, G.D. (2008). *High-impact educational practices: What they are, who has access to them, and why they matter*. Washington D.C.: Association of American Colleges and Universities.

Kuh, G.D. (2017). Foreword~~,~~. In B. Eynon, ~~B.~~ & ~~L.M.~~ Gambino, L.M. *High impact ePortfolio practice: A catalyst for student, faculty, and institutional learning.* Virginia: Stylus Publishing.

Kuh, G.D., & O'Donnell, K. Eds. (2013). *Ensuring quality and taking high-impact practices to scale*. Washington, DC: Association of American Colleges and Universities.

Levy, P. (2011). Embedding inquiry and research into mainstream higher education: A UK perspective. *CUR Quarterly, 32*(1), 36-42. http://www.cur.org/DOWNLOAD.ASPX?ID=2803

MIT (2017). Undergraduate Research Opportunities Program. http://uaap.mit.edu/research-exploration/urop

NSF (2006). *Strategic plan: Investing in America's future*. Arlington, Virginia: NSF.

Neary, M. (2014). Student as Producer: Research-engaged teaching frames university-wide curriculum development. *CUR Quarterly, 35*(2), 28-34. http://www.cur.org/DOWNLOAD.ASPX?ID=3070

Research and Teaching Forum (2006). Response to reform of higher research and funding. Submitted to David Sweeney, Director for Research for HEFCE.

Roxå, T., & Mårtensson, K. (2015). Microcultures and informal learning: a heuristic guiding analysis of conditions for informal learning in local higher education workplaces. *International Journal for Academic Development*, *20*(2), 193–205.

Shanahan, J.O., Ackley-Holbrook, E., Hall, E., Stewart, K., & Walkington, H. (2015). Ten salient practices of undergraduate research mentors: A review of the literature. *Mentoring & Tutoring: Partnership in Learning, 23*(5), 359-376.

Shanahan, J.O., Walkington, H., Ackley, E., Hall, E. E., & Stewart, K.A., (2017). Award-winning mentors see democratization as the future of undergraduate research. *CUR Quarterly, 37*(4), 3-8.

Spronken-Smith, R.A., Brodeur, J J., Kajaks, T., Luck, M., Myatt, P., Verburgh, A., Walkington, H., & Wuetherick, B. (2013). Completing the research cycle: A framework for promoting dissemination of undergraduate research and inquiry. *Teaching and Learning Inquiry. 1*(2), 105-118. http://www.jstor.org/stable/10.2979/teachlearninqu.1.2.105

Turner, N. (2017). Personal communication, 25 July.

University of Adelaide (nd) Small group discovery experience. https://www.adelaide.edu.au/learning/strategy/sgde/

Walkington, H. (2015). *Students as researchers: Supporting undergraduate research in the disciplines in higher education.* York: HE Academy. https://www.heacademy.ac.uk/sites/default/files/resources/Students%20as%20researchers_1.pdf

Walkington, H. (2016). *Students as researchers*. York: Higher Education Academy. https://www.heacademy.ac.uk/sites/default/files/resources/walkington-students-as-researchers.pdf

Willison, J., & O'Regan, K. (2007). Commonly known, commonly not known, totally unknown: A framework for students becoming researchers. *Higher Education Research & Development*, *26*(4): 393–409.

Zimbardi, K., & Myatt, P. (2014). Embedding undergraduate research experiences within the curriculum: A cross-disciplinary study of the key characteristics guiding implementation. *Studies in Higher Education, 39*(2), 233–250.

Table 1. The role of academic developers in supporting undergraduate research and inquiry.

1. Raise awareness and participate in the development of policy
2. Influence the funding policies which currently exclude and undervalue undergraduate research and inquiry
3. Open-up opportunities for discussion and debates to bring about institutional change
4. Raise issues of student learning in extra-curricular undergraduate research experience programs
5. Provide guidance on challenges that arise when students are taken off-site to carry out research in the community, in the field or at research laboratories
6. Carry out surveys or audits of existing practice
7. Initiating conversations about how research experience and skills are taught across the curriculum
8. Support academics with interpersonal challenges involved with undergraduates
9. Support students navigate their way through the messiness and complexity of academic life

Source: Based on Brew and Jewell (2012, pp. 53-56).

Table 2. Strategies to support individual staff who teach through student research and inquiry.

1. Develop courses that engage students in research and inquiry from the beginning of their first year
2. Ensure that progression in research and inquiry is built into programmes
3. Celebrate and share what is already in place
4. Create opportunities for faculty and students to experiment
5. Review and enhance what is in place
6. Ensure that initial training in teaching and subsequent continuing professional development emphasize student research and inquiry
7. Reshape academic timetables
8. Create alternative learning spaces

Source: Jenkins and Healey (2015, p. 31).

Table 3. Departmental and course team strategies to mainstream undergraduate research and inquiry.

1. Review understanding *and practice of undergraduate research and inquiry*
2. Develop a set of related curricula interventions, such as the ones identified by the Boyer Commission (1998):
    - *Make Research-Based Learning the Standard*
    - *Construct an Inquiry-Based Freshman Year*
    - *Build on the Freshman Foundation*
    - *Culminate with a Capstone Experience*
3. Offer undergraduate research and inquiry as a pervasive and early element of the curriculum
4. Give students experience of undertaking research and inquiry with different levels of independence
5. Link undergraduate research and inquiry to student employability
6. Ensure assessment practices and policies support students as researchers
7. Include all students in some practices and be selective in others

Source: Based on Healey and Jenkins (2009, pp. 70-73).

Table 4. Institutional examples of embedding research and inquiry.

Higher Education Provider	Institutional approach	Further information
University of Adelaide, Australia	Small group discovery experience	University of Adelaide (nd)
Humboldt University of Berlin, Germany	Research-based education	Deike (2014)
University of Lincoln, UK	Student as producer	Crawford et al. (2015); Neary (2014)
Maastricht University Netherlands	Extending problem-based learning to research-based learning	Bastiaens et al. (2017)
McMaster University, Canada	Problem-based and inquiry-based learning	Knapper (2007)
Miami University, US	Student as scholar	Hodge et al. (2011)
Massachusetts Institute of Technology, US	Undergraduate Research Opportunity Program	MIT (2017)
Olin College of Engineering, US	Group project-based entrepreneurial engineering design projects	Kearns (2004)
Quest University, Canada	Research-based education	Helfand (2016)
Roskilde, Denmark	Problem-oriented project-based learning	Andersen et al. (2015)
University College London, UK	Research-based education and the connected curriculum	Fung (2017)

Table 5. Strategies for academic developers to mainstream undergraduate research and inquiry within institutions.

A. Develop supportive institutional strategies and policies

- Ensure that undergraduate research and inquiry are clearly recognized in these strategies. This applies particularly to institutional teaching and research strategies, but other policies, such as decisions supporting student employability and community engagement, may also offer possibilities for intervention

B. Encourage and support student awareness and experience of undergraduate research and inquiry

- Ensure that early career and continuing professional development courses explicitly include strategies to support undergraduate research and inquiry
- Work with student organisations to help them to be partners in promoting undergraduate research and inquiry

C. Ensure institutional practices support undergraduate research and inquiry

- Intervene to ensure quality assurance, quality enhancement and institutional assessment processes and policies support students as researchers
- Align student support from library, information and communication technology services, and laboratories with needs of students undertaking undergraduate research and inquiry

D. Encourage academic staff awareness and support and reward engagement with undergraduate research and inquiry

- Provide support to academic staff with regard to professional development so that they are encouraged to become engaged in undergraduate research and inquiry
- Intervene in institutional policies to provide incentives and rewards for academic staff to support undergraduate research and inquiry, particularly through workload planning, institutional and departmental promotion policies and decisions

Source: Based on Healey and Jenkins (2009, pp. 80-81).

Table 6. National strategies for developing undergraduate research and inquiry.

1. Fund high quality learning resources to support student research and inquiry
2. Ensure quality assurance and enhancement systems support undergraduate research and inquiry
3. Ensure research funding supports research dissemination and undergraduate research
4. Target research opportunities to students in particular disciplines
5. Target research opportunities to students from under-represented groups
6. Encourage disciplinary and professional associations to support undergraduate research and inquiry
7. Recognise and value student organisations playing a leading role

Source: Based on Healey and Jenkins (2009, p. 106).

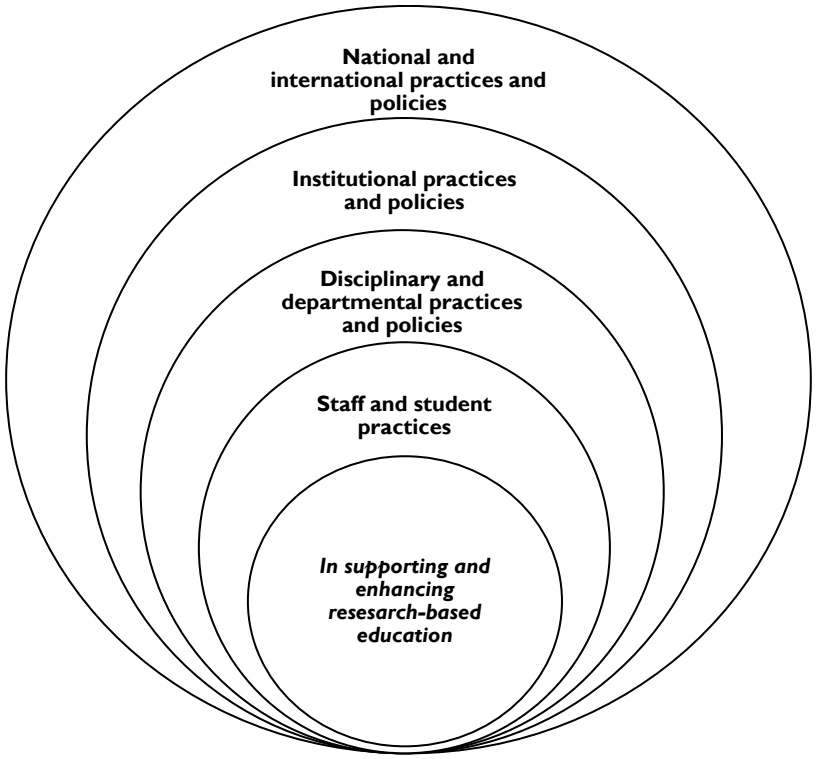

Figure 1. Embedding of research-based education by level.