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Final Report

Teaching, technology and educational design

the architecture of productive
learning environments

Senior Fellowship

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<http://www.altcexchange.edu.au/teaching-design>

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2010



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This end of program report has two main purposes.

It provides a formal record of project aims and achievements (Section 1).

It provides a concise introduction to some of the core ideas, approaches and resources developed during the program (Section 2).

Thanks

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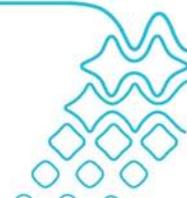
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There are too many ALTC Fellows to name, so I will have to risk offending some by mentioning those who have had a particularly influential role in my work: Ron Oliver, Angela Brew, Dave Boud, Ian Cameron.

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Errors, interpretations and infelicities of style are all down to me. PG July 2009.



1. Overview

Executive summary

This Final Report provides an account of the work accomplished during my Fellowship program. It focuses on the period during which I was able to work intensively on Fellowship activities (February 2008 to April 2009). One benefit of the Fellowship is that invitations to speak about my work, run workshops, provide advice and contribute to new projects arrive every week. Indeed, the rate of growth of interest in educational design appears to be accelerating.

Design is the key theme in my work. The steady shift to more active forms of learning in higher education means that university teachers have to think carefully about the design of good learning tasks – productive things for students to do – as well as about the resources that students will need if they are to stand a reasonable chance of succeeding in their activities. These ‘resources’ turn out to be many and varied. For some activities, it is enough to have access to carefully selected literature, undisturbed time to read and reflect, and a chance to discuss important ideas. The success of other activities may depend on having appropriate space to work with peers, access in that space to online information and collaboration tools, and occasional timely guidance from a teacher. The incursion of new technologies, and their increasing variety and sophistication, bring new opportunities for learning but also present much more complex design challenges. How can university teachers best help students to make good use of time, space, technology, peer networks and the myriad resources of the Internet?

My Fellowship program addressed this issue in four inter-connected ways.

1. By identifying a core set of design tools and information sources, suitable for use by university teachers, working either individually or in teaching teams. An annotated guide with links to online sources is now available on the ALTC Exchange. The URL for my design work on ALTC Exchange is <http://www.altcexchange.edu.au/teaching-design>
2. By producing a pattern book as a resource for designing for activities of learning through discussion and learning through inquiry. This pattern book uses an approach to capturing and sharing educational design experience that is based on design patterns and pattern languages. The approach originates in architecture, has been very successful in software engineering, and is now attracting great interest in the world of educational technology. The pattern book is available at the ‘Teaching as Design’ site mentioned above.
3. By working with people in senior leadership positions in a number of universities – especially PVCs for Learning and Teaching and Heads of Educational Development Units – to identify structural and cultural barriers to the uptake of the ideas and practices of ‘teaching as design’. Workloads models that are based on face-to-face lecturing turn out to be one such obstacle in a significant number of universities.
4. By making presentations, writing articles, running workshops, holding symposia and editing collections of work by those involved in research and development in the educational design field. Two books and a special issue of a journal on educational design patterns and pattern languages were completed during the Fellowship program period.

The challenges of producing good designs for learning are still very great. Indeed they may become greater as students’ needs diversify, personal technologies proliferate and pressures on space, resources and the teaching workforce become more intense. But design is also a strategy for survival. It helps us rethink, analyse what’s important, and focus our actions accordingly.



1.1 Background to the fellowship: identifying core issues

While it is hard to generalize across the wide and disparate range of teaching and learning activities in higher education, one significant shift can be detected. In rough terms, it can be defined as a shift in emphasis from what the teacher says, to *what the learner does*.

This recognition of the centrality of student activity can be seen in many places. It underpins use of the term 'active learning'. It is key to John Biggs's notion of 'constructive alignment'.ⁱ It is at the heart of concepts like 'student engagement'.ⁱⁱ

Lecturing still has an important place in higher education. Being able to give a clear, insightful explanation, or an inspirational overview of a topic, remain important abilities of a good teacher. But the growth of interest in active learning needs to be accompanied by the addition of complementary skills in *design*: in thinking up good learning tasks, and ensuring that students have access to the tools and resources they need to complete the tasks they are set.

A number of changes in tertiary education are making teachers' design work more difficult but also more necessary. The incursion of ICT is the most obvious of these. ICT offers opportunities to make learning and teaching more flexible – less bound by the constraints of time and space – but, poorly used, it generates substantial discontent among students.ⁱⁱⁱ Students need to experience ICT as something that is integrated with their everyday learning activity: not something which is crudely 'bolted on'. Tasks and technology need to match.

If ICT use is to be integrated smoothly into students' learning activities, then care is also needed in harmonising the planning and management of physical and virtual spaces – something which has, at best, a patchy record in HE.^{iv} Also, there needs to be careful alignment in planning and managing the physical and virtual components of learning environments at various scale levels: macro-level decisions turn out to have serious implications for pedagogy at the local level.

The growing importance of good educational design also reflects a recognition that students' needs are becoming more diverse, that teaching staff are under increasing pressure to provide better education with fewer resources, and that employers' expectations of new graduates are not diminishing. Reproducing traditional practices can be efficient if the environment is static, but in times of rapid change, methods need to be rethought. Well-grounded innovation and good design go hand in hand.

Lastly, there is a growing acknowledgement in HE that sustainable innovation cannot be left to a cadre of enthusiasts. Enthusiasts burn out or move on. Good design takes time and needs a rich mix of skills. For these reasons, teaching teams rather than individual teachers provide a better focus for the nurturing of design-led approaches. When teaching teams (and associated technical and educational specialists) work together to do something new, the fruits of their efforts are much more likely to endure.^v



1.2 Educational design within the fellowship program

The Fellowship program was concerned with *educational design*. I use this term to cover:

- the design of good learning tasks,
- the work involved in making sure that students have access to the tools and resources they need to complete such tasks successfully, and
- making appropriate arrangements for students to work together, and to have timely access to teachers and other people who can support their learning.

The emphasis on design is motivated by a recognition that the time that teaching staff have available is under increasing pressure: it is a scarce and valuable resource that needs to be used where and when it can have the best effect. Time spent on ‘upstream’ activities – as in the design of good learning tasks – is a better investment than time spent managing the fallout from poor design.

The design phase of teachers’ work also offers better opportunities for drawing on the experience of others, and for making use of research-based evidence about good learning and teaching. (Nobody consults the learning sciences literature while giving a lecture. Some people consult the literature while designing a course. Even more people draw on research-based evidence and principles if these have been embedded in some useful design tools.)

The program had a particular focus on educational design work that involves the use of learning technologies (broadly defined). This is partly because the introduction of new technologies into higher education *complicates* the work of teaching and learning, but also because ICT-based design tools come more readily to hand when the educational tasks being planned also make some use of ICT.

That said, the program had much deeper implications for reconceiving teaching – broadening its scope to cover all the work that is done to provide support for learning, and placing special value on the notion of *teaching-as-design*.^{vi}

The Fellowship program work can be summarized under four main headings:

1. Identifying, collating and annotating design resources suitable for use by teachers and teaching teams in higher education.
2. Producing a ‘pattern book’ as a resource for the design of inquiry-based learning and learning through discussion.
3. Working with heads of EDUs, PVC/DVCs L&T/Education and other senior staff to identify issues that inhibit shifting the balance of teachers’ work towards greater involvement in design; identifying strategies to work on these problems.
4. Making presentations and writing articles – for the general media as well as for academic consumption – about teaching-as-design, architectural conceptions of the design and management of learning environments, etc.



1.3 Summary of achievements

I will deal with this in two passes. First, I will try to convey a sense of the success, or otherwise, of the planned work – talking about achievements in relation to the goals and deliverables in the proposal. Second, I will talk about some of the unexpected outcomes (mostly positive) and some unanticipated problems.

1. Design resources: Two sets of annotated design resources were mounted on the ALTC Exchange. A preliminary set was uploaded in May 2008. These were accompanied by the launch of my blog on 'Teaching-as-Design'. A revised set of annotated resources was uploaded in July 2009. The revision benefited from feedback from my international team. Despite a number of efforts to publicise the existence of these resources, they have not been bookmarked or commented upon within ALTC Exchange. I think there are two reasons for this. First, most people who are looking for the kinds of resource listed in the set will move straight on to find the resource itself – almost always, the original resource is on a website external to the Exchange. Second – as some others have noted – the ALTC Exchange has not yet become a regular point of call for the great majority of people in HE. In the recommendations and lessons learned section, below, I provide some further thoughts on this matter. In brief, I also think there is an issue limiting the functionality of the Exchange, because it is conceived as a marketplace for ideas, rather than as a tool directly supporting teachers' work. I would argue that one can expect to have greater beneficial effects if one embeds good pedagogical ideas in useful tools.

2. Pattern books: A design pattern is a unique way of capturing and distilling design experience, rendering it more shareable. Patterns can be assembled into a pattern language, to solve a specific design problem. A pattern book is a collection of design patterns and pattern languages. Two pattern books were originally drafted. Feedback was obtained from members of the international team with special interests in design methodology, as well as from other people who have a particular interest in design patterns. Some of the patterns were trialled in workshops and conferences in Australia and overseas. A revised pattern book, merging both sets of patterns, has now been produced and is available via ALTC Exchange. (More information about pattern books and the patterns-based approach can be found in the body of this report.)

3. Strategies for helping universities become more supportive of educational design: The work here involved some formal and many informal interactions with people in learning and teaching leadership roles in universities in Australia and overseas. Through discussions and interviewing, I identified a number of common problems and, with the help of the T&L leaders and some members of my international team, sketched some candidate strategies for addressing the main areas of concern. Some of the recommendations developed through this work have been captured in a book I have written with Robert Ellis.^{vii} Others have been written up and presented at workshops and conferences. It would be possible to distill a short booklet on this topic, aimed at T&L leaders and others in middle to senior management positions, but this has not yet been done. (See recommendations for further work, below.)

4. Presentations and articles: This has been very successful with respect to the literature read by those who influence teaching and learning in universities (in Australia and overseas), and not successful with respect to more mainstream audiences. As I mentioned in my interim report, it has proved particularly difficult to generate a *sustained* debate within those parts of the mainstream press that cover HE. Occasional *news* pieces are one thing; a series of *op ed* pieces quite another. A list of invited keynotes and other presentations is given in the Appendix to the report. I have run workshops and related events in New South Wales, Queensland, Victoria and Western Australia, as well as overseas. Three major publications associated with the program are worth mentioning:

- A book on students' experiences of e-learning, drawing out implications for educational design and the management of learning spaces, written jointly with Robert Ellis and published by Routledge.



Work on this book began just before the start of the ALTC fellowship, and the book draws on data from our ARC-funded research, but insights from the ALTC fellowship work were useful in shaping the introduction and later chapters of the book, and ALTC support is mentioned in the book because it expedited the writing. Due to appear September 2009.

- A book on educational design patterns and technology enhanced learning, co-edited with Simos Retalis (University of Piraeus, Greece).

The start of work on this book also predates the ALTC fellowship, but the fellowship provided some valuable time to complete a number of editorial tasks and to write two of the book chapters. ALTC is acknowledged in this book too. The book is to be published by Sense Publishers (Rotterdam) as part of their Technology Enhanced Learning series. It is likely to appear late in 2009 or early in 2010.

- A special issue of the Elsevier journal, *Computers in Human Behavior*, on design patterns in e-learning.

This collection of eight papers (190pp) has been produced in collaboration with Simos Retalis and Yannis Dimitriadis (University of Valladolid, Spain). The collection is different from, and complementary to, the chapters in the Sense book mentioned above. It will appear as Volume 25, Issue 5 (pp997-1188) of the journal, in November 2009.

A listing of chapter/article titles and authors for the Sense book and the *Computers in Human Behavior* special issue can be found below in Appendix 1.

1.4 Unexpected outcomes

I will pick out just two outcome areas where spin-off activities led by others have proved serendipitous.

First, it has been gratifying to see individuals and teams of teachers pick up teaching-as-design and design pattern ideas from things I have written, or spoken about at conferences, without my direct involvement in the early stages of their work. Examples would be the use of design patterns to share teaching methods and other aspects of valued pedagogy in the masters program of the Faculty of Education at Queensland University of Technology, and also the use of design patterns in creative writing courses at the University of Southern Queensland.^{viii}

Secondly, I think there have been some wonderfully constructive overlaps in interests among the network of ALTC Fellows. I have had some very constructive discussions at UQ and Sydney with Ian Cameron, one of the first senior fellows. We discovered a shared interest in the affordances of learning spaces. There have been some very useful and inspiring conversations with other fellows – some with obvious common interests (e.g. Ron Oliver, Angela Brew, Matthew Allen) and others where deeply shared common interests only became apparent after considerable time. The fellowship meetings organized by ALTC staff have been very valuable in this regard, and I think more could be done to extract value for the L&T community through fellowship network activities (see Appendix 2).



2. Main report

In this section of the report, I have set out to provide a concise introduction to the main ideas and approaches developed, and work undertaken, during the Fellowship program period. For those who wish to explore the area more deeply, there are links to program deliverables and to other resources that may prove to be of value.

2.1 Teaching-as-design: the key idea

Figure 1 is useful in explaining the idea of Teaching-as-design.

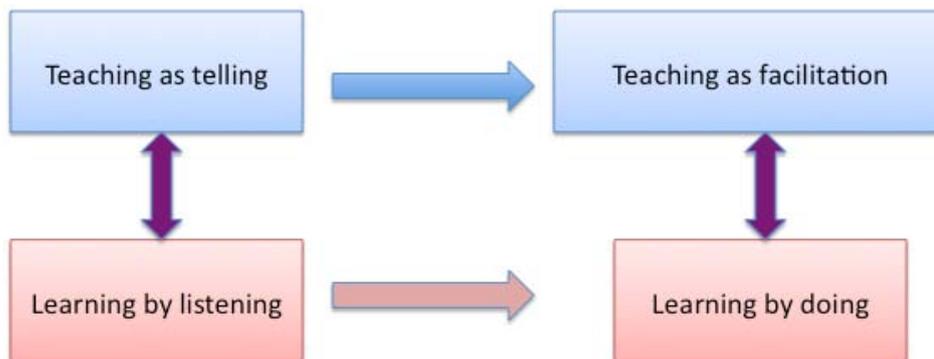


Figure 1: *From the sage on the stage to the guide on the side...*

Figure 1 is, of course, a gross oversimplification of the dominant conceptions of teaching and learning in higher education, but it helps draw attention to a neglected aspect of teachers' work. Figure 1 reflects an argument that teaching should move, and is moving, away from a focus on teachers' expository work and towards a focus on what students *do*. In the public mind, in media representations, and in the expectations that many first-year students bring to university, the image of teaching as being primarily a matter of lecturing is still powerful. Research on university teachers' conceptions of teaching, and students' conceptions of learning, regularly reveals the dichotomy shown above. Some conceptions focus on teachers and their exposition of content. Some conceptions focus on learners, on what they need and what they do.^{ix}

Lecturing has a legitimate place in higher education. Lectures play a number of valuable roles that are not always well-understood. It is worth the effort to improve lectures and lecturing.^x That said, most of the learning that students do does not occur in lectures. Very little of it actually occurs when students are face-to-face with their teachers. Students may be involved in worthwhile study activity while they are in lectures (listening carefully, making notes, etc). But most of the sense-making, conceptual change, development of real understanding, ability to apply knowledge in new situations, honing of skills, etc – what we really mean by learning – occurs at other times and in other places. Once we acknowledge that the totality of what students gain from their time in higher education is rooted in the totality of their experiences – in all of what they do – then what is said in lectures falls into place as just one of many important elements.^{xi} Couple this broader vision of student learning with an emphasis on active learning, learning by doing, 'minds on' as well as 'hands on' learning, and the significance of the shift to the right in Figure 1 becomes clearer.

The shift towards more active, student-centered conceptions of learning is accompanied by a shift, or perhaps a broadening or elaboration, of conceptions of teaching. The cliché in the caption of Figure 1 reflects the most visible or dominant interpretation of the changing requirements placed on the teacher. They become facilitators of learning, monitoring and guiding learning activity, moderating discussion, spotting problems and stepping in to repair things when necessary.



Figure 2 is meant to challenge this interpretation of conceptions of teaching.

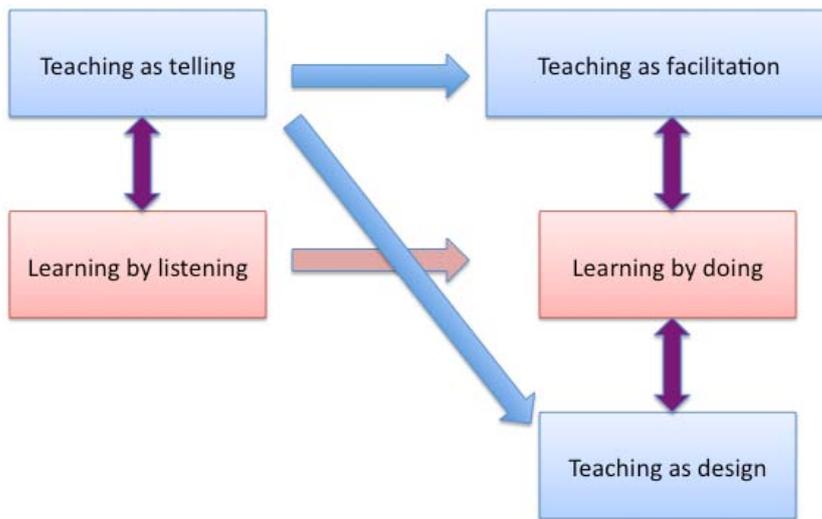


Figure 2: From the sage on the stage to the guide on the side to the team with a scheme...

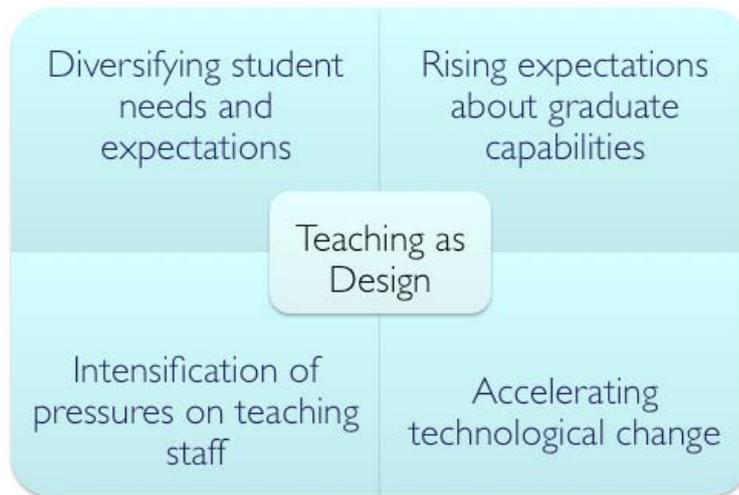
The main message of Figure 2 is that the emphasis on teaching as facilitation is misplaced, or at least tells the less important part of the story. If *what students do* is the most important determinant of what they learn, then they need to be set really good learning tasks. They also need to have access to the tools, resources, workspaces, etc needed to succeed with those tasks, and they need good access to people who can help them – including other students. Thinking up good tasks – ones that align with intended learning outcomes – is not easy. It takes time and planning. Tasks need to be designed. Ensuring that the learning environment is properly furnished (in the broadest sense of that word) is also a complicated task. One needs to think about the affordances of tools and spaces – what kinds of activity they promote – and about the effects of different ways of distributing work across groups or communities of learners. Again, this planful, painstaking but inherently creative activity bears all the hallmarks of design. In short, active learning needs teachers to work as designers^{xii}.

In the section after next, I describe the nature of teaching-as-design in more detail. Before that, I want to sketch some of the forces that are shaping teaching-as-design in contemporary higher education.



2.2 Forces shaping teaching-as-design in higher education today

Increasing stress on traditional teaching practices



Accumulating research evidence about learning and teaching

Figure 3: Teaching-as-design in the context of contemporary higher education

Figure 3 identifies four broad areas of change that set a context for, but also explain the value of, an approach to teaching that emphasizes design.

First, the involvement of greater numbers of students in higher education, including many whose families have had no experience of higher education, is introducing greater diversity of need, expectation and outlook. The shift from elite to mass higher education *has* to be accompanied by greater flexibility and responsiveness to take account of varying student needs. Without this, efforts to reduce social inequalities in access to the benefits of higher education will fail.

Second, employers – and governments speaking on their behalf – are not satisfied with graduate abilities. And within academia there has been much debate – influenced but not constrained by employers' expressed demands – about equipping graduates for the uncertain needs and challenges of the 21st century.^{xiii} Geoffrey Boulton and Colin Lucas put this well in a recent report for the League of European Research Universities. They argue that many of the qualities prized by government and employer organisations – 'entrepreneurship, managerial capacity, leadership, vision, teamwork, adaptability and the effective application of specific technical skills' are derived from more fundamental capabilities that universities are well-placed to foster.

'Even an education directed towards immediate vocational ends is less than it could be, and graduates are left with less potential than they might have, if it fails to engage the student in grappling with uncertainty, with deep underlying issues and with context. Generation by generation universities serve to make students think. They do so by feeding and training their instinct to understand and seek meaning... (Students) are taught to question interpretations that are given to them, to reduce the chaos of information to the order of an analytic argument...to seek out what is relevant to the resolution of a problem...to identify problems for themselves and to resolve them by rational argument supported by evidence; and they learn not to be dismayed by complexity but to be capable and daring in unraveling it.' (Boulton & Lucas, 2008, p9).^{xiv}



Third, we need to recognize that ICT, which has moved from an esoteric to a mission-critical role in teaching and learning in just 15 years, still possesses a great deal of disruptive potential energy. Technical innovation has not hit a plateau. It is still accelerating exponentially. Social uptake of technologies is accelerating and diversifying. The big strategic questions about the relationship between ICT and higher education over the last decade have been how to accommodate, and provide equitable access to, the World Wide Web. In the next few years, strategic attention will shift to questions of managing the interface between institutionally-provided and personal technologies. The MIT architect Bill Mitchell has helped us see that the challenges are not about making choices between the 'real' and 'virtual' worlds, but making sense and good use of increasingly complex mixtures of the physical and the digital: hybrid spaces, augmented realities, ubiquitous computing and ambient intelligence.^{xv} Planning how to match valued educational activities with the complex affordances of such hybrid spaces – how to align technology and pedagogy – is a matter of careful design.

Fourth, demands on the time and intellectual energy of teaching staff are intensifying, and there are few signs of this trend softening. Staff:student ratios are worsening. Administrative burdens get heavier. There is pressure to spend more time on research rather than teaching. This means that any strategies intended to help teachers improve learning *must* be realistic about the time and energy available. I have two subsidiary points to make here. One is that teaching-as-design is not *just* an approach that makes realistic assumptions about the limited time that teaching staff have available: indeed, part of its motivation is to save teaching time, and to improve the ratio between time spent and educational benefits delivered. Good design saves time later down the track, as well as improving educational quality. Also, shifting from traditional to design-led practices can help rethink and rearrange some of the relationships between research and teaching – such that we can focus more on their synergies and be less damaged by their competition for our time. In short, not only is a 'designerly' approach to teaching more time-efficient, it can also help counter the fragmentation of our working lives.

In addition to the increasing pressures that question the sustainability of traditional teaching practices, Figure 3 also draws attention to an uncomfortable fact about the relations between research and practice. Over the last 30 years or so, research in the learning sciences has produced a robust body of evidence about how people learn: in formal education and in the rest of their lives, in higher education as well as schooling, with and without technology, individually and through collaborative activity.^{xvi} This evidence base is strong enough to guide us towards good ways of teaching and learning, in a variety of discipline areas. It is certainly strong enough to provide compelling evidence about why some traditional teaching practices are likely to fail to deliver their intended results.

There are numerous competing diagnoses for the breakdown between teaching practices in higher education and research on learning. University teachers are not always trained, equipped or predisposed to read and interpret articles reporting research on learning. Educational research, like every other area of research, has specialized language that can seem to be obfuscatory jargon to the uninitiated. It can be very hard to work out the local, practical implications of apparently universal pedagogical principles. The final part of the argument for teaching-as-design is that it is in the design stages of teachers' work that we find the best opportunities for making use of relevant research. There is time, during the design phase, to consult the literature, or those who know it. Moreover, tools and resources that support educational design activity can be carriers of good ideas: research-based evidence and the fruits of successful teaching experience can be embodied in the resources that teachers use at design time^{xvii}. One way of doing this is described in some detail in the section below on design patterns and pattern languages.

To summarise the argument embedded in Figure 3: the sustainability of established teaching practices is in doubt because (1) more students, with increasingly diverse needs, are entering higher education; (2) we need to improve the quality of the education we provide; the social, environmental, political and economic challenges of the 21st Century will place



extraordinary demands on our graduates; (3) the pace of technological change is accelerating; technology is not a solved problem and it is not going to go away; (4) the demands on university teachers are intensifying; good teachers are burning out; the workforce is ageing fast; it will get harder to recruit and retain good teachers as global competition for talent heats up.

When the reproduction of traditional practices begins to fail, because of changes in the external environment, then invention and design become essential. A more design-savvy approach to teaching is not only realistic, it is absolutely necessary.

2.3 Teaching-as-design: the design problem-space and its components

So what does 'teaching-as-design' encompass? Figure 4 provides an abstract representation of the key elements.

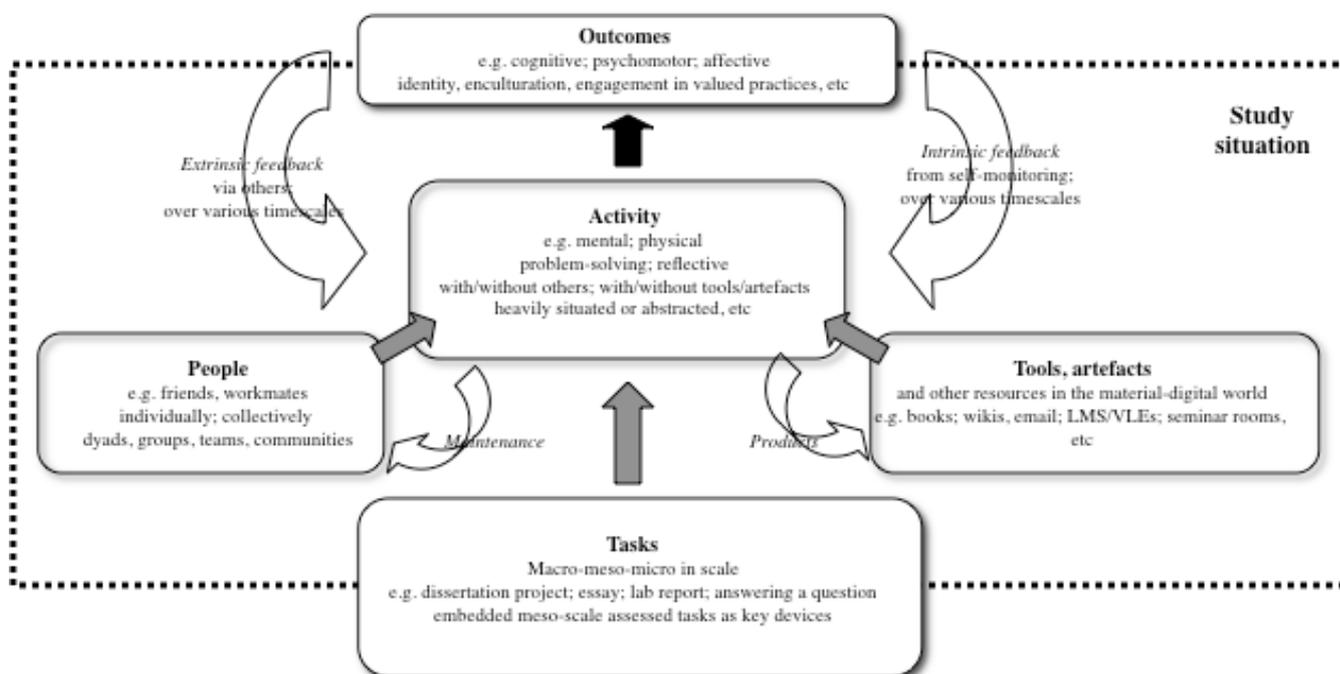


Figure 4: The problem space of teaching-as-design

At the heart of this diagram is the relationship between activity (what the student does) and outcomes (what the student learns). Outcomes vary in kind. There are a number of taxonomies of outcome, from the work of Bloom in the 1950s or Biggs in the 1970s, to newer taxonomies which reflect more recent findings from cognitive psychology and the learning sciences. The key point is that *different kinds of knowledge are acquired in different ways*. One cannot learn a skill without practice. One cannot understand a new idea without connecting it to existing knowledge.^{xviii} Good design involves mapping the connections between desirable outcomes and student activity. An additional source of complexity comes from the fact that most of the activities we ask students to engage in actually have multiple intended learning outcomes, and that sometimes these goals can be in conflict, or at least in competition. Take, as an example, situations in which we want students to acquire a better personal understanding of idea x or principle y, but we simultaneously want them to develop teamworking and self-regulation skills. Design frequently involves finding workable trade-offs between competing priorities.

Figure 4 separates 'tasks' from 'activities'. Tasks are what teachers set. Activities are what students actually do. The two are not the same. For a mixture of good and bad reasons,



students don't always do what we ask them to do. On the plus side, we normally set tasks with enough openness that students can adapt the tasks to suit their needs and interests. We might set an essay topic, and let the student decide on the exact wording of the question. We might set some requirements for a project, but leave enough flexibility in the specification of the task that students can relate the project to their current or prospective work situation. Students will also make their own decisions about how much time and effort to dedicate to an activity, given other demands (academic and non-academic) with which they are having to deal. There is a substantial literature showing that students vary in their approaches to learning – in their intentions and strategies. These too play out in the nexus between task and activity.^{xix}

In a way, this further complicates the process of design. We have to set tasks hoping that the activities they provoke will align with a set of intended learning outcomes, but we (usually) *want* students to exercise some autonomy and creativity in translating tasks into activities. This makes educational design in higher education more *indirect* than is the case in classic models of instructional design. These classic models – with roots in military and industrial training – usually assume a logic of control, firmly connecting the task set to the learner's actual activity. (Trainee soldiers will do what they are told. University students don't and shouldn't. Classic instructional design assumes a compliant learner. Teaching in higher education doesn't and shouldn't.) This might, at first glance, seem to make design in higher education unusually, perhaps impossibly, unpredictable and difficult. But actually it places teaching-as-design in the same territory as product designers and architects. By and large, people who design products and buildings do not assume compliant users. They deal in influence and subtle affordances, rather than command and control.^{xx}

Two other elements of the problem space of teaching-as-design are illustrated in Figure 4. These acknowledge the influence of people and things on the nature of students' activity. For some 20 years now, there has been a line of analysis in cognitive psychology and the learning sciences that shows how learning activity – and other kinds of human activity – need to be understood as socially and physically situated.^{xxi} In brief, this means that what people do, and indeed what they are able to do, are influenced in subtle and profound ways by the people and things around them. The way I tackle certain tasks, and the extent of my success, can be influenced quite powerfully by whether I have access to a word processor, the World Wide Web, or indeed pencil and paper. Ideas that occur to me in solitude are not the same as ideas that occur in conversation with someone else. Some activities only make sense to me in relation to the response of an imagined audience.

The fact that learning activity is both physically and socially situated means that the quality of the activity and its likely outcomes are influenced by factors that are only partially under the teacher's control. In relation to design, this means that teachers have responsibility for thinking about the tools and other material and digital resources that could be most useful to the students, and taking steps to see that students have good access to such resources. Similarly, if the teacher comes to the view that such and such a task would best be tackled by students working in pairs, or in teams, then they also have a responsibility for proposing appropriate groupings and divisions of labour. Students will, of course, make their own choices about what resources to use, and whether and just how they will work with others. But this freedom, and the consequent uncertainty, don't absolve the teacher-designer of their responsibilities.

To sum up, the idea of teaching-as-design in higher education embraces two key ideas. (1) Activity is key, but design can only influence – not control – what students do. (2) The teacher as designer is not just responsible for proposing good things to do. They also have to attend to influential physical and social qualities of the learning environment, but in the knowledge that what is recommended or set in place may be ignored or transformed by the students.

Table 1 adds a further dimension to our conception of the problem space of teaching-as-design: that of *scale*.



	Task	Tools (etc)	People
Macro	How sets of tasks are arranged, sequenced etc to form the backbone of a course. Timeframe: weeks or months	The overall physical and virtual environment in which all student activity is set. Often dealt with by central university services teams, but scope runs broader than that.	The arrangement of people, especially students and teachers, into course cohorts, learning communities, etc
Meso	The design of a single task – mapping onto a single coherent activity. Timeframe: days or weeks	The set of tools, spaces, other resources needed for the learners' work on a specific activity. Usually the concern of a teacher or program team; may be co-configured by the learner(s).	Arrangement into working groups that persist for the length of the activity.
Micro	The design of sub-tasks that provide structure to an activity. Timeframe: minutes or hours	Tools, resources etc needed for the activity generated by a specific subtask. Usually the concern of a teacher; frequently co-configured by the learner(s).	Involves consideration of individual interactions between learners, and between learners and teachers

Table 1: Considering tasks, tools and people (the three main components of design) at three scale levels.

Most of the work that I have been doing with teachers in higher education operates comfortably at what is labeled, in Table 1, the *meso*-level. Many of the formally assessed tasks that teachers set their students can be located at the meso-level. Design work at the other levels is recognizable to most teachers, but it is less of a common feature in their working lives. That said, alignment between levels, and coherence across design components, are recognized as very important (though sometimes relegated to the ‘too hard’ basket).

In this regard, I have found Table 1 an extremely useful resource for talking about the problems of communication within universities, both up and down the scale levels and across the design components. For example, senior managers of university IT services can be comfortable talking about matters located in the ‘*macro x tools*’ cell of Table 1, but they tend to be less comfortable talking about the micro-level, and even more nervous talking about problems of aligning pedagogy and technology at the micro-level. Yet it is at this detailed level of the fit between task-activity-technology that real problems are experienced. The devil is in the details. More junior IT staff may be very knowledgeable about the functionality of tools at the micro-level, but they too can become very nervous when confronted with the kinds of language and issues that emerge in the ‘*macro x tasks*’ cell of Table 1. (At the risk of inviting caricatures, I leave plotting the comfort zones of PVCs L&T on Table 1 as an exercise for the reader.)

2.4 Summary of teaching-as-design

This excursion into conceptualizing teaching-as-design is necessary because it helps map the kinds of activities in which teachers need to engage. It also begins to map related territories that are (or need to become) the domain of everyone else involved in supporting students’ learning.

This relates to the remainder of my Fellowship work in two ways. First, this extended notion of teaching-as-design helps define the space within which design resources are needed. If university teachers – alone or in course teams – are to become better at designing, they



need appropriate tools, resources and other kinds of guidance. Second, it is a necessary backdrop for thinking about what universities need to do if they are to become more supportive of design: to become more design-savvy organisations.

Sections 2.5 and 2.6 summarise progress and achievements in each of these two areas.

2.5 Creating resources for design

My work under this heading can be divided into two areas, each of which maps onto a substrand in the project proposal and onto specific project deliverables. In the proposal, I described these as follows:

Strand 1) Improving access to resources that can help strengthen the practices of educational design in Australian higher education

1a) identify a range of robust and well-supported sets of design methods, tools, templates, patterns and other resources and provide a concise, annotated directory aimed at teachers in higher education.

1b) create a pattern book (a set of design patterns and pattern languages) for learning through discussion and learning through inquiry. This pattern book is intended to be useful in its own right, but also an example of how teaching-as-design can be supported through the use of design patterns.

1a) The annotated directory of design resources: was produced in two main versions, one early on in the program and one towards the end. The early version was mounted on what was then the Carrick Exchange. The later version is now on the ALTC Exchange. The directory contains links to, and descriptions of, a variety of design resources, ranging from software tools that directly support design activity, to libraries of re-usable design examples and case studies, to texts which provide pithy guidance about design matters. See <http://www.altcexchange.edu.au/teaching-design>

An observation that should be made here concerns the underlying architecture of the ALTC Exchange – or perhaps its informing image of how materials in the Exchange can connect with practice. I have tried to summarise what might be done, in this regard, in a recommendation in Appendix 2.

The fundamental issue is one of how we conceive of users of the ALTC Exchange actually doing their work. Of course, there is an almost infinite range of ways in which teachers can prepare and plan. I will use two contrasting images to make the key point.

One can imagine a teacher considering how s/he will structure a new course, to be taught next year. In an extended process of thinking about, discussing and researching possibilities for this course, the teacher spends some time browsing for resources on the World Wide Web, including searching some learning object repositories in various countries, and looking for inspiration or reusable resources in the ALTC Exchange. There is a long arc between finding an idea or resource and embedding it, or its implications, in the new course.

Contrast this with a more time-pressed teacher, who is having to make decisions about good learning tasks, tools to be used, and/or appropriate student grouping strategies with only a day or two of lead time. This teacher will be working with some tools – PowerPoint, WebCT, etc – and the route to influencing their practice, with the highest probability of success, is to embed good ideas *in* these tools. Just as an architect's computer-aided design (CAD) system can do much more to support creative design than run a bunch of calculations, so we can imagine an educational CAD system providing support for creative pedagogical design. This is the short arc solution: it reduces the chance of good pedagogical ideas falling through the gaps.



I would argue that the ALTC Exchange is better aligned to 'long arc' approaches than it is to 'short arc' approaches. It needs to be complemented by a suite of tools that provide an educational equivalent of the architect's CAD system.^{xxii}

1b) The pattern book: has also evolved through several versions, including being split into two pattern books (one for learning through discussion and one for learning through inquiry) and then recombined into one. The latest (one volume) version can be accessed on the ALTC Exchange.. See <http://www.altcexchange.edu.au/teaching-design>

Experience on the Fellowship program has strengthened my belief that the patterns-based approach has a good deal to offer educational design, particularly in relation to:

- Providing the teacher-designer with a comprehensive set of design ideas;
- Providing these design ideas in a structured way – so that relations between design components (design patterns) are easy to understand;
- Combining a clear articulation of a design problem and a design solution, and offering a rationale which bridges between pedagogical philosophy, research-based evidence and experiential knowledge of design; and
- Encoding this knowledge in such a way that it supports an iterative, fluid, process of design, extending over hours or days.

The original ideas for design patterns and pattern languages come from the writings of Christopher Alexander on architecture and town planning.^{xxiii} Alexander's intention was to democratise architecture and town planning by offering a set of conceptual resources that ordinary people could use in (re)shaping their environment. His work provides a principled, structured but flexible resource for vernacular design. In my view, he strikes the right balance between rigour and prescriptiveness – offering useful guidance without constraining creativity and providing helpful foci for design. His approach is also supportive of a shifting of design power from technical specialists to those who inhabit educational spaces – teachers and learners.

The notion of design patterns has been picked up more recently within the field of software engineering – where it has been used to capture and share aspects of software engineering experience and as a way of representing successful models for the implementation of information systems.^{xxiv} Teachers of software engineering have also been experimenting with the idea of pedagogical patterns and educational technologists have been trying to apply a patterns-based approach to working on problems such as learning object descriptions, inter-operability, learning management standards, etc.^{xxv}

Design patterns have a number of qualities which, in combination, give them the potential to be a useful way of sharing experience in the field of networked learning. A pattern is a solution to a recurrent problem in a context. In Alexander's own words, a pattern ...

"describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice"
(Alexander et al., 1977, p.x).

Context is important in helping constrain and communicate the nature of both problem and solution. Describing the context for the problem and its solution avoids over-generalisation. In addition, patterns should also teach. They should be written in such a way that they help the reader understand enough about a problem and solution that they can adapt the problem description and solution to meet their own needs. The rationale for the pattern helps with this teaching or explanatory function. Ideally, the name of the pattern should crystallise a valued element of design experience and help relate it to other design elements such that we can create and use a pattern language. The use of patterns, then, can be seen as a way of bridging between philosophy, values, theory, empirical evidence and experience (on the one



hand) and the practical problems of design.

Alexandrian patterns have the structure shown in Figure 5.

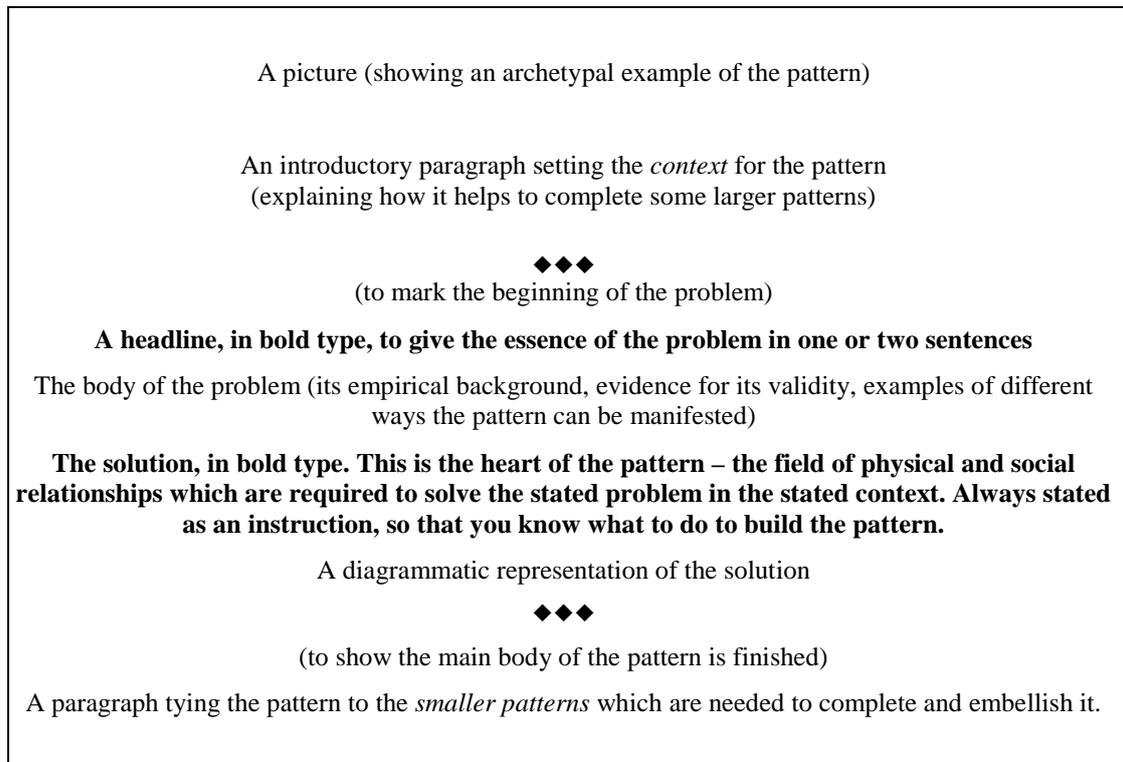


Figure 5: the structure of a typical Alexandrian pattern.

An example pattern from the 'discussion group roles' section of the pattern book illustrates how this Alexandrian structure can be made to work in an educational setting. (Note, for brevity, the 'rationale/elaboration' section – the 'body' – of the pattern has been omitted here.



WRAPPER

This pattern defines a role that is useful in a number of Group Task Patterns: notably in the context of DISCUSSION-BASED LEARNING and DISCUSSION GROUPS



In an active, spirited discussion, it's not easy for everyone to keep track of ideas and conclusions. Most people are concentrating on what they want to say next, rather than reflecting on, and trying to commit to memory, things that have been said. Good ideas get lost, and in the long run this can be demoralising.

Therefore:

Give one or two students the role of discussion WRAPPER. They should take notes during the discussion, capturing points of importance. These may be ideas or key arguments that shaped the discussion. They may be conclusions or decisions about the direction of future work. Brief the WRAPPER so that they focus on key ideas and don't try to record the whole history of the discussion. The WRAPPER should have five minutes or so at the end of the discussion to present their 'wrap'. Brief the other participants so that they know it's OK to ask the WRAPPER to note something down.



Patterns needed to complete this pattern include: NOTEPAD, WRAP. SCRIBE is an associated role.

Figure 6: Design pattern for a 'wrapper'

Forming a pattern language involves painstaking, iterative work, travelling in two directions. From the bottom up, one can sketch individual design patterns, to capture recurrent problems and solutions from our collective experience as educational practitioners, interpreting these also through the lens of research-based evidence and theory. From the top down, one can try to structure the problem space of design, scoping out the largest and smallest patterns, and sketching relationships between patterns (written and as yet unwritten). Neither approach is sufficient on its own and each can lead to contradictions and problems for the other – hence the need for iteration, revision, patience and a tolerance of ambiguity.

For further information, see the *Patterns book* on the ALTC Exchange.

2.6 Helping universities become more supportive of design

Strand 2) Identifying strategies that senior staff can use to help create a more supportive climate for educational design

The main goal here was to work with a selection of senior staff from a range of universities to identify (i) issues that impede more designerly approaches to teaching (ii) strategies for dealing with such issues.

The original plan was to work with a panel of PVCs L&T, heads of educational development units, etc., in a structured manner – with three rounds of issue identification and strategy definition, leading to a concise booklet distilling guidance.

As it turned out, it proved much easier to work with PVCs L&T, senior staff of EDUs and others involved in educational leadership and management, in more direct and informal ways. In large part, this meant taking opportunities to set up discussions with people in these roles whenever I was visiting universities as part of the Fellowship program work, or when I was working with them in other contexts. Early face-to-face meetings were supplemented with subsequent phone conversations centered on draft documents.



Although these working methods were less structured than I had envisaged they would be, I think the outcomes were actually better. In part, this is because senior staff were understandably reluctant to speak openly about what might be seen as weaknesses in their own institutions. When able to speak more privately, off the record, and in a non-attributable way, I think their comments were actually more candid and useful.

A number of themes, problem areas and strategies were uncovered through this process, and I was able to do some checking across institutions to get a sense of the extent to which issues were institution-specific or more general. The key issues and strategies are summarized briefly below. An analysis of some of what emerged through work in Strand 2 was fed into the closing chapters of the book that I wrote with Rob Ellis during 2008.^{xxvi}

‘Design-savvy universities’: issues and strategies. The most salient concerns that emerged from this work can be summarized as follows:

- Induction: new teaching staff rarely have more than the equivalent of a few days of induction to ideas about, and methods of, teaching. Given the broad range of learning, teaching, assessment and curriculum issues that already compete for space in such induction programs, finding room for ideas about *design* is difficult. Until more staff become capable at design, a design-led approach remains untested and it’s hard to justify displacing other topics/approaches covered in induction programs. (Catch 22.)
- New staff have to fit into an existing teaching culture. Even though it’s reasonable to predict that the age-balance in university teaching departments will start to come down, with the retirement of baby-boomers, scope for a significant shift in teaching cultures seems limited. New staff may be more enthusiastic or ‘natural’ users of technology, but their approaches to teaching are not necessarily less conservative or teacher-centered than those of their older colleagues.
- Workloads measurement and management methods in many institutions do not provide incentives for investing extra effort in ‘design time’. Sometimes, a reduction in face-to-face contact hours, designed to allow students more time to work together on projects, is backfilled with extra teaching duties. Management methods that concentrate on teaching hours input rather than the quality of educational output do not encourage smart design. Also, in many institutions, significant details of how workloads are measured and models implemented, are delegated to school/department level and are hard for senior management to change, even if they saw the need to do so.
- In some universities, design is seen as a specialist province of instructional designers. There would be resistance to the idea that every teacher should become a designer.
- It may be argued that design-led approaches work best when teachers teach in teams, but team teaching is rare and the occasions when groups of teachers work closely together are even rarer. The coordination costs of working as a team are seen – in some places – to outweigh the benefits that might flow, and are judged to be a significant disincentive for many teachers.
- Course aims and objectives change with increasing frequency – especially where there is pressure from an external professional body or employer group, and/or where student demand is volatile. Technology is changing every few years; infrastructures are seen as unstable. Staff doubt that they will get a return on investment of effort at design time, because the courses (etc) they design will need to be revamped prematurely.
- There are suspicions about the word ‘design’: it has resonances of control, scheming, manipulation, etc. (Conversely, some academics will be cynical about an attempt to appropriate the sense of ‘cool’ that goes with design.)



Put in this condensed form, the kinds of doubts and issues that arose in discussions with PVCs, heads of EDUs and associated staff seem serious enough to kill any ideas about 'teaching-as-design'. Actually, the discussions usually took a more positive turn – partly because few of the participants saw the current state of affairs as either desirable or sustainable. A number of the issues raised actually *require* the kind of approach that we associate with design – but implemented in a more fundamental or thoroughgoing way.

2.7 Wider dissemination of, and debate about, teaching-as-design

The third and final strand of the program was aimed at more general consciousness-raising with respect to teaching-as-design.

Strand 3) Contributing to debate about the changing nature of teaching in higher education

This was envisaged, at the time of the proposal, as falling into two main areas, each relating to the needs of a specific audience. First, I planned to give talks, run workshops and hold discussions about teaching-as-design, focusing on the needs of people working in learning and teaching roles in universities. I also planned to write some articles about the key ideas, again aimed at an audience within academia. Second, I planned to write a series of articles for the mainstream media – or at least those sections of the mainstream media that pay occasional attention to higher education – in order to question common assumptions about the essential characteristics of university teaching.

The first proved productive and relatively straightforward; the second much less so.

Appendix 1 lists talks given and books and articles produced. This became an increasingly active strand of the program, which felt enjoyable, interesting and useful in itself, although the effects were limited to the rather closed world of university teaching and learning. Invitations continue to come in. My sense is that interest and impact are still growing.

Appendix 1 also lists a variety of workshops, presentations and other events connected with the Fellowship. Here, I want to single out the 'extended seminar' for particular attention.

The 'extended seminar' was the occasion for bringing together as many members of my international team as could make it to Australia. It ran between 29 November and 10 December 2008, starting in Brisbane and ending in Sydney. We ran a symposium at the AARE conference in Brisbane. (In addition, together with Professor Marilyn Goos (ALTC Fellow, UQ), Professor Alison Lee (UTS), Dr Catherine Doherty (QUT), and Professor Peter Renshaw (UQ), I participated in the ALTC-sponsored closing plenary session at the AARE conference.) After the AARE conference, the team moved to Sydney, where we held four days of intensive meetings on three related topics:

- Friday 5 December: Workshop on learning and teaching in higher education, focusing on issues of strategic change. Convened by Professor Paul Trowler & Murray Saunders; attended by DVC/PVCs Academic/L&T and other staff associated with EDUs from universities in the Sydney region, as well as by staff from ALTC.
- Monday 8 December: Pedagogical planner summit.
- Tuesday & Wednesday 9 & 10 December: Workshop on learning through inquiry, teaching as design.

Details of the individual sessions, participation lists, etc can be found in Appendix 1.



The unforeseen problem with promoting a more **public debate** arises from the way in which (a) there are actually very few outlets in the Australian print media for opinion pieces on higher education, (b) the HE-focussed print media are news-driven not ideas-driven. While it was not difficult to get coverage for the program when it was first announced (news-driven), it was much harder to get space subsequently to air the ideas.

These experiences have led me to formulating a recommendation to ALTC, which, with the help of other Fellows, is I think well-placed to provide a platform for debate. See Appendix 2, *Recommendations*.



3. Where next?

I see the work involved in this Fellowship program as a continuing strand of activity, connected closely with my ongoing professional interest and involvement in learning and teaching in higher education, appropriate use of technology and methods of educational design. The Fellowship year provided a wonderful opportunity to accelerate some developments in this area and to lay firm foundations for further work. I also take the view that there are benefits for the HE community, for ALTC and for fellows if fellowships are treated as lifelong: that fellows should volunteer – as their circumstances allow – to engage in activity that promotes the ALTC mission. Thus, although it is important to be able to show how Fellowship program funds are spent, and what benefits flow from that investment, there should also be a sense of connectedness between the work in the Fellowship program year and future activities of the Fellow.

Talks, workshops, etc: I will be continuing to give talks, run workshops, and hold meetings with people who shape higher education learning environments. The status and visibility bestowed by the ALTC Fellowship helps with this. Events range in scope and scale. I will be 'dinner speaker' at the CSUED2009 Conference on *Learning and Leading in Higher Education*, (Thursday 26 November, Charles Sturt University, Thurgoona campus. <http://csued2009.wildapricot.org>) I am also keynoting at the 2009 International Convention of the Association for Educational Communications and Technology (Oct 27-31, Louisville Kentucky. <http://www.aect.org/events/Louisville/keynote.asp?clientid>). AECT is the largest society involved in educational technology in the United States. I also have plans to run a workshop and/or present about the Fellowship work at the AARE Conference in Canberra (November), the ascilite conference in Auckland (December) and the Learning Design conference in Wollongong (December).

International visitors & networking: between September and November I will be hosting two international visitors who want to find out more about the work I have been doing during the fellowship program period. Professor Philippa Levy is Director of CILASS: the Centre for Inquiry-based Learning in the Arts and Social Sciences at the University of Sheffield, UK. (CILASS is a national Centre of Excellence in Teaching and Learning (CETL), funded by the UK Higher Education Academy. <http://www.shef.ac.uk/cilass/team/plevy.html>) Dr Yael Kali works at the Technion - Israel Institute of Technology, Haifa, Israel and (with Professor Marcia Linn, University of California, Berkeley), directs the US NSF-funded educational Design Principles Database project. <http://www.edu-design-principles.org/dp/designHome.php>

Books: Participants in the Fellowship program's extended seminar, held in Brisbane and Sydney in late November/early December 2008, sowed the seeds for an edited book on *Learning as Inquiry, Teaching as Design*. I expect to have a contract for this book within the next 2-3 months. Beyond that, I think the time is right for a book-length treatment of the whole set of ideas concerning teaching-as-design in higher education. I plan to write this during 2010.

Further projects: I am optimistic that some of the ideas I have been promoting during the Fellowship program are germinating in other institutions. For example, colleagues at QUT and USQ have been using design patterns to capture important elements of their pedagogy and are considering submitting a project proposal to ALTC to take this work further in 2010. Also, Dr Lina Markauskaite, Associate Professor Robert Ellis and I have received ARC funding for two Discovery projects that will explore aspects of learning through inquiry and cognitive aspects of educational design (both set in higher education contexts). Both started in 2009. On a larger scale, there is scope for a programmatic exploration and development of the teaching-as-design area as part of the workplan in ARC Centre of Excellence and Commonwealth Cooperative Research Centre proposals being developed for 2010.



Appendix 1: Activity summary

1a: Talks, workshops, meetings and other presentations, milestones

2007	
22 May	Fellowships announced; interviewed for piece in <i>The Australian</i>
12 Sept	Carrick/ALTC Curriculum Roundtable
8 Oct	Fellows' Induction Day
22 Oct	Presentation on <i>University students' interpretations of educational tasks: implications for rethinking educational design</i> , Faculty Research Festival, University of Sydney
23 Oct	Meeting with Eddie Gulc, UK Higher Education Academy
2-5 Dec	Attended ascilite conference in Singapore. Presentation on <i>Students' interpretations of learning tasks: implications for educational design</i>
2008	
1 Feb	<i>Formal start of Fellowship</i>
11-12 Mar	Fellows' meeting, Sydney
19 Mar	Presentation to Learning & Teaching Committee of the Academic Board, The University of Sydney
31 Mar – 11 Apr	Study visit to UK (including visits to London, Oxford & Hertfordshire Universities)
9 May	Meeting with Mia O'Brien (UQ) re SOTL and visit to UQ
11-13 May	Participation as invited HE expert at Australian Davos Future Summit (Hilton, Sydney)
18-20 June	Meetings at UQ and keynote at the Third International Blended Learning Conference "Enhancing the Student Experience" (held simultaneously at Univ of Hertfordshire, UQ and the University of Calgary).
27 June – 4 July	Visit to University of Canterbury (NZ) and participation in HERDSA conference (Rotorua, NZ); discussions with Ako Aotearoa staff, HERDSA executive & others
24 July – 20 Aug	Work with Dr Michael Derrtl (Univ Vienna) on educational design patterns
20 Aug	Meeting with James Dalziel re LAMS-patterns collaboration; December workshops
1-2 Sep	ALTC Fellows' meeting, Brisbane
17 Sept	Meeting with ALTC Senior Fellow Ian Cameron
21-22 Sept	Workshop and presentations on educational design & blended learning, James Cook University, Townsville
3-5 Nov	Workshop and keynote presentation at Edith Cowan University, Perth
6 Nov	Invited presentation at Higher Education IT Summit, Hilton Hotel, Melbourne
28 Nov	Meeting with Professor Berner Lindstrom, University of Gothenburg
29 Nov – 10 Dec	<i>Extended seminar in Brisbane & Sydney, comprising:-</i>
29 Nov	AARE conference Brisbane. ALTC Symposium. ALTC panel as closing event.
5 Dec	Workshop in Sydney: strategic change (Paul Trowler, Murray Saunders)
8 Dec	Pedagogical planner summit
9 – 10 Dec	Learning through inquiry, teaching as design meeting
2009	
10-12 Feb	Media Training workshop & ALTC Fellows' Forum, Holiday Inn, Sydney
27-30 April	Workshops, presentations and discussions at Hong Kong Institute of Education and Hong Kong University
30 April	<i>Formal end of Fellowship program</i>
25 June	Design patterns meetings and workshop at QUT, Brisbane
30 June	Matthew Allen's ALTC fellowship workshop at UTS (participating as mentor)
6 – 9 July	HERDSA conference in Darwin; presentation on teaching as design and epistemic fluency
31 July	<i>Final report submitted.</i>



1b: Writing

The Fellowship program provided some writing/preparation time for the following:

Ellis, R., & Goodyear, P. (in press 2009).

Students' experiences of e-learning in higher education: the ecology of sustainable innovation. New York: RoutledgeFalmer

Goodyear, P., & Retalis, S. (Eds.) (forthcoming 2009).

Technology-enhanced learning: design patterns and pattern languages. Rotterdam: Sense Publishers

Dimitriadis, Y., Goodyear, P., & Retalis, S. (2009) Using e-learning design patterns to augment learners' experiences. Guest editors' introduction to Design patterns for augmenting e-learning experiences, Special Issue of *Computers in Human Behavior* (25, 5) 997-1188 (8 papers, 191pp).

Goodyear, P & Ellis, R (2008) University students' approaches to learning: re-thinking the place of technology, *Distance Education*, 29(2) 141-152 (special issue guest edited by J Michael Spector & M David Merrill)

Goodyear, P & Ellis, R. (forthcoming) Students' experiences of learning in the digital age, Chapter 2 in Sharpe, R., Beetham, H. & de Freitas, S (eds). *Rethinking learning for the digital age: how learners shape their own experiences*. New York: RoutledgeFalmer.

Markauskaite, L & Goodyear, P (submitted) Tapping into the mental resources of teachers' working knowledge: insights into the generative power of intuitive pedagogy, Paper for *Annual Conference of the Australian Association for Research in Education*, Canberra

Goodyear, P & Markauskaite, L (2009) Teachers' design knowledge, epistemic fluency and reflections on students' experiences. Paper for the *Annual Conference of the Higher Education Research & Development Society of Australasia*, Darwin, July 2009

Keynotes and other invited presentations

Goodyear, P (2009) Learning technology and teaching-as-design, Invited presentation, University of Hong Kong, 30 April 2009.

Goodyear, P (2009) Blended learning, active learning and teaching-as-design, Invited presentation, Hong Kong Institute of Education, 28 April 2009.

Goodyear, P (2008) The role of technology in supporting off-campus education, invited presentation, Informa IT in Higher Education Summit, Melbourne, 6 November, 2008.

Goodyear, P (2008) Learning, technology and teaching-as-design: culturing innovation and inquiry. Keynote address, ECULTURE conference, Edith Cowan University, Perth, 5 November, 2008.

Goodyear, P (2008) Blended learning, shared experience. Keynote address, 3rd International Conference on Blended Learning, Brisbane, Australia and Hatfield, UK, 19 June, 2008



Articles/chapter titles and authors involved in the Patterns book and special issue

Goodyear, P., & Retalis, S. (Eds.). (forthcoming 2009). *Technology-enhanced learning: design patterns and pattern languages*. Rotterdam: Sense Publishers

- 1 Learning, technology and design
Peter Goodyear & Symeon Retalis
- 2 A contextual framework for identifying instructional design patterns
Andrew S Gibbons
- 3 Generating CSCL scripts: from a conceptual model of pattern languages to the design of real scripts
Davinia Hernández-Leo, Juan I. Asensio-Pérez, Yannis Dimitriadis, & Eloy D. Villasclaras-Fernández
- 4 Using patterns for computer-mediated interaction for creating CSCL environments
Stephan Lukosch & Till Schümmer
- 5 Design patterns for collaborative learning experiences in online 3d worlds
Franca Garzotto & Caterina Poggi
- 6 A pattern in the making: the contextual analysis of electronic case-based learning
Christian Voigt
- 7 E-learning frameworks = (design patterns + software components)
Rafael A Calvo & Aiman Turani
- 8 Patterns as the first step towards the generation of learning scenarios
César Moura, John Hicks & Alain Derycke
- 9 A heterogeneous pattern language for collaborative learning systems and intelligent tutoring systems
Andreas Harter & Alke Martens
- 10 Design patterns for inspection-based usability evaluation of e-learning systems
Petros Georgiakakis, Symeon Retalis & Yannis Psaromiligkos
- 11 Embedding pedagogical principles and theories into design patterns
Fiona Chatteur, Lucila Carvalho & Andy Dong
- 12 Design patterns: connecting systemic functional linguistics and pattern languages
Dai Fei Yang
- 13 The practitioner's perspective on design patterns for technology-enhanced learning
Michael Derntl & Renate Motschnig-Pitrik
- 14 The distributed developmental network d2n: a social configuration to support design pattern generation
Niall Winters, Yishay Mor & Dave Pratt
- 15 Best practice for the pattern scout
Till Schümmer
- 16 Sharing practice, problems and solutions for institutional change: comparing different forms of representation
Gráinne Conole & Chris Jones
- 17 Organizational patterns for e-learning centres
Maria Zenios, Christine Smith
- 18 Design patterns for technology enhanced learning: achievements and opportunities
Symeon Retalis, Agnieszka Bachfischer & Peter Goodyear



Special Issue of *Computers in Human Behavior* (25, 5) 997-1188 (eds Dimitriadis, Goodyear, Retalis).

Using e-learning design patterns to augment learners' experiences, Y. Dimitriadis, P. Goodyear, S. Retalis

In search of common ground: A task conceptualization to facilitate the design of (e)learning environments with design patterns, Ilya Zitter, Geert Kinkhorst, Robert-Jan Simons, Olle ten Cate

From pattern to practice: Evaluation of a design pattern fostering trust in virtual teams, Ellen Rusman, Jan van Bruggen, Ron Cörvers, Peter Sloep, Rob Koper

Design patterns for monitoring and evaluating CSCL processes, D. Persico, F. Pozzi, L. Sarti

Incorporating assessment in a pattern-based design process for CSCL scripts, Eloy D. Villasclaras-Fernández, Davinia Hernández-Leo, Juan I. Asensio-Pérez, Yannis Dimitriadis

Lessons learnt in mining and writing design patterns for educational interactive graphics, Christian Kohls, Jan-Georg Uttecht

Grounded design: Design patterns as the link between theory and practice, Wouter van Diggelen, Maarten Overdijk

The role of design-principles in designing courses that promote collaborative learning in higher-education, Yael Kali, Rachel Levin-Peled, Yehudit Judy Dori

Dealing with abstraction: Case study generalisation as a method for eliciting design patterns, Niall Winters, Yishay Mor



The Extended International Seminar (Brisbane – Sydney; 30 November to 10 December)

Note: the material here has been lightly edited from materials used in organizing the events that made up the extended seminar. They are intended to give a flavour of what transpired and who was involved.

AARE Symposium: Learning technology and ‘teaching-as-design’

Chair: Prof Peter Goodyear (University of Sydney)

Discussants: Prof Paul Trowler (Lancaster University) &
Prof Roger Säljö (University of Gothenburg)

Presenters:

Prof Diana Laurillard (London Knowledge Lab, Institute of Education, London University, UK)

Dr Chris Jones (Institute of Educational Technology, Open University, UK)

Prof Peter Goodyear & Dr Lina Markauskaite (CoCo, University of Sydney)

Prof J Michael Spector & Dr ChanMin Kim (Florida State University, USA)

Symposium abstract

This symposium offers a chance to discuss and reflect upon some of the design-oriented aspects of teaching activity. We take a broad-based perspective on teaching – one which includes the work of a variety of people who help create and sustain productive learning situations – but we have a particular interest in situations where computer technology plays a significant role. The individual contributions address design at several scale levels: from the design of learning and assessment tasks to the shaping of organization-wide learning infrastructure. Each paper reports on research and development activity that is grounded in the complex, messy problems of educational innovation. Each uses this grounding as a source of insight into the changing demands of teaching-as-design, and outlines some fruitful ways of conceptualising and researching the interplay between learning, technology, teaching and design. Individually, the papers look at tools for teachers (to help support their design work), knowledge for design and collective engagement in the creation and management of learning infrastructure. Collectively, they provide an opportunity to explore and question some fundamental assumptions about the practices, purposes and technologies of learning, teaching, assessment and educational design. The presentations will take a number of forms. Some will illustrate key ideas and challenges by reference to prototype tools and systems. Others will share outcomes of recent research on teaching and design. Two researchers who are recognised internationally for their expertise in higher education (Paul Trowler and Roger Säljö) will act as discussants. The symposium is part of Peter Goodyear’s work as a Senior Fellow of the Australian Learning and Teaching Council. Although higher education is a core area of expertise for each of the presenters, the symposium should be of interest to researchers interested in all sectors of education.



*Workshop on Change Strategies
Enhancing Learning and Teaching in Higher Education
University of Sydney, Friday 5 December 2008*

Background

This invitation-only workshop is for senior staff involved in the enhancement of learning and teaching in higher education, drawn from the ALTC (Australian Learning and Teaching Council) and from universities in New South Wales.

It will be led by Professors Paul Trowler and Murray Saunders from Lancaster University in the UK. Murray Saunders and Paul Trowler bring a social practice perspective to the findings of three large evaluation studies of national initiatives to enhance learning and teaching in UK higher education: the Learning and Teaching Support Network (now Subject Centres); the Scottish Quality Enhancement Framework and the England and Northern Ireland Centres for Excellence in Teaching and Learning. They use this experience and analysis to reflect on effective change strategies in higher education.

The workshop will include presentations from Paul and Murray but will also offer plenty of time for discussing L&T enhancement strategies, seen at national (ALTC), institutional, and faculty levels. Murray and Paul are co-authors of a forthcoming book for the Open University Press (*Enhancing Teaching, Learning, Assessment and Curriculum in Higher Education*) and of the UK Higher Education Academy guide '*Change Theory: Change Practices*'

http://www.heacademy.ac.uk/assets/York/documents/ourwork/institutions/change_academy/id262_Change_Thinking_Change_Practices.pdf

Bios

Paul Trowler is Professor of Higher Education at Lancaster University. His research focuses on change and the implementation of higher education policy particularly at institutional and departmental level. He is particularly interested in the significance of disciplinary and contextually-specific locations for leadership and change management as well as in academic staff and organizational learning as they relate to the enhancement of teaching and learning in higher education. Recent publications include: Trowler, P. (2008) *Cultures and Change in Higher Education*. London: PalgraveMacmillan. Becher, T. and Trowler, P. (2001) *Academic Tribes and Territories: intellectual enquiry and the cultures of disciplines* (2nd edition). Buckingham: Open University Press/SRHE. Knight, P. and Trowler, P. (2001) *Departmental Leadership in Higher Education: new directions for communities of practice*. Buckingham: Open University Press/SRHE. Trowler, P. (ed) (2001) *Higher Education Policy and Institutional Change: intentions and outcomes in turbulent environments*. Buckingham: Open University Press/SRHE.

<http://www.lancs.ac.uk/fass/edres/profiles/12>

Murray Saunders is Director of the Centre for the Study of Education and Training at Lancaster University, where he also holds the chair of Evaluation in Education and Work. Murray is past president and Council member of the UK Evaluation Society, a Board member of the European Evaluation Society, and chair of the co-ordinating committee for the establishment of the IOCE (International Organisation for Cooperation in Evaluation). He has directed a number of major educational evaluation studies in the UK, including several addressing national strategies for learning and teaching enhancement in higher education. He also has extensive educational evaluation experience from directing and working on projects in the EU, Africa, Latin America and Asia. Publications include: Saunders, M (2006) The presence of evaluation theory and practice in educational and social development: toward an inclusive approach, *London Review of Education* Vol. 4, No 2, pp. 197-215 Saunders, M (2006) From 'organisms' to 'boundaries': the uneven development of theory narratives in education, learning and work connections *Journal of Education and Work*, Vol 19, No 1, pp 1-27 Saunders M, Bonamy J and Charlier B (2005) Using evaluation to create 'provisional stabilities': bridging innovation in Higher Education change processes, *Evaluation: the International Journal of Theory, Research and Practice*, Volume 11, Number 1, pp 37-55 Saunders M and Machell J (2000) Understanding emerging trends in higher education curricula and work connections, *Higher Education Policy* 13 pp287-302

<http://www.lancs.ac.uk/fass/edres/profiles/Murray-Saunders>



Workshop convenor:
Peter Goodyear
Professor of Education and Co-director of the CoCo Research Centre, University of Sydney
ALTC Senior Fellow

Note: This event is being organised as part of the program of activities associated with Peter Goodyear's work as a senior fellow of the Australian Learning and Teaching Council (ALTC). Peter's fellowship activity is concerned with the use of ICT in higher education and especially with the notion of improving the design aspects of university teachers' work. The support of ALTC is gratefully acknowledged. Further information: <http://www.altcexchange.edu.au/teaching-design>



Pedagogical planner summit and design workshop

Monday 8 December, University of Sydney, Room 438 Old Teachers College

Background

Today's event combines a 'Pedagogical Planner Summit', which has been organised under the umbrella of the Sydney LAMS conference, with an opportunity to discuss future collaborations in the area of learning technologies, educational design and 'teaching-as-design'. The event is co-organised by James Dalziel and Leanne Cameron (LAMS/MELCOE, Macquarie University), Sue Bennett (Cognition and Learning Design Group at the University of Wollongong) and Peter Goodyear (CoCo, University of Sydney).

Aim

To provide an opportunity for researchers active in the area of pedagogical/activity planners, educational/learning design, etc to report on their recent work, share perspectives and discuss promising lines for future work.

Draft program:

9.30 – 10.00	Welcome; perspectives on the day (James Dalziel, Sue Bennett, Peter Goodyear)
10.00 – 11.00	Presentations: Grainne Conole; Sue Bennett
11.00 – 11.30	Morning tea
11.30 – 12.30	Presentations: Diana Laurillard; Peter Goodyear
12.30 – 1.30	Lunch
1.30 – 2.00	Presentation: Leanne Cameron
2.00 – 2.15	Reflections: Mike Spector
2.15 – 3.00	Final discussion & next steps: led by James Dalziel, Sue Bennett, Peter Goodyear
3.00 – 3.30	Afternoon tea
3.30 – 4.30	Discussion and planning further work (ALTC team, MELCOE team, UoW team)

The morning 'presentations' sessions each involve two contributions of around 15-20 minutes each, followed by 20-30 minutes for discussion, Q&A etc stimulated by that pair of presentations. The afternoon presentation session will similarly be of 15-20 minutes with 15 minutes or so for discussion, Q&A related to that presentation. Mike Spector has kindly agreed to provide some thoughts reflecting on the day's presentations and discussion and we'll use this to segue into a more general discussion. All participants are welcome to stay for afternoon tea.

From 3.30 to 4.30 (or so) we'll have a smaller group – mainly Peter Goodyear's ALTC program participants, colleagues from the Cognition and Learning Design Group at the University of Wollongong, LAMS/MELCOE, and Gráinne Conole – discussing how we want to take some of the ideas forward.



Pedagogical planner summit: Participant list

First	Last	Institution/Organisation
Belinda	Allen	UNSW
Sue	Bennett	CLDG, UOW
Leanne	Cameron	MELCOE, Macquarie University
Gráinne	Conole	IET, Open University
James	Dalziel	MELCOE, Macquarie University
Shirley	Evans	UOW
Fran	Everingham	Sydney University
Paul	Gagnon	Nanyang Technological University, Singapore
Peter	Goodyear	CoCo, USYD
Jennifer	Jones	CLDG, UOW
Matthew	Kearney	UTS
ChanMin	Kim	LSI, Florida State University
Lisa	Kosta	CLDG, UOW
Diana	Laurillard	Institute of Education, University of London
Robyn	Phillip	Educational Consultant
Tony	Robins	RMIT
Debbie	Richards	MELCOE, Macquarie University
Michael	Spector	LSI, Florida State University
Trish	Treagus	ALTC



Learning through inquiry; teaching as design
Tuesday & Wednesday 9 & 10 December, 2008

Aims

Under the 'umbrella' of Peter Goodyear's ALTC fellowship program, this small (n=15 or so), invitation-only workshop will share and test some ideas associated with the theme of 'Learning through inquiry; teaching as design'. Because of the ALTC connection – and the interests of many of the participants – the background is learning and teaching in higher education (L&T in HE), though the ideas (etc) almost certainly have broader potential.

People participating in the workshop have one or more of the following interests and areas of expertise:

- Understanding complex learning (especially when ICT is involved)
- Tools and methods for educational design
- Enhancement of learning and teaching in higher education.

Among the issues we will focus on:

- Considering our tools, methods & conceptions of educational design – how far short do they fall of what we know about complex learning? What do we need to know (what research needs to be done) to help close the gap?
- How well or badly do available (and projected) tools/methods for educational design fit with what we know about the design work of teachers and teaching teams in HE? How promising is the notion of 'teaching as design' as a strategy for the sustainable enhancement of L&T in HE? Again, what do we need to know/research to close any identified gaps – or to rethink strategies.

In a way, both of these sets of issues represent challenges to current work on design tools/methods. One line of critique is that they don't help much with designs for complex learning (such as various kinds of inquiry-based learning), and/or they miss or gloss over some key problems with complex learning. They reflect rudimentary or defective pedagogies. The other line of critique is that HE L&T practices don't align particularly well with the idea (and technology) of teaching as design. But criticism is easy. To feel that we've done something useful through this workshop, it would be good to strive for a clearer vision of what might best be done to advance the improvement of L&T, taking into account the best of what we know about 'good learning' and taking seriously the ideas of improving the design of worthwhile learning tasks (etc).

What do we need to understand more clearly in order to tackle this? What new issues need to be placed on the research agenda? Do we need to reconnect with some neglected areas of knowledge?

Intended outcomes

In addition to any new understandings etc that we arrive at during the two days, we will also have some time to consider concrete ways of capitalising on the workshop discussions: (a) working together, after the event, on a special issue of a journal or on an edited book; (b) one or more research and/or R&D proposals; (c) other proposals as they emerge.

Participants

Chris Jones, ChanMin Kim, Diana Laurillard, Gráinne Conole, James Dalziel, Leanne Cameron, Jan Herrington, Mike Spector, John Sweller, Michael Jacobson, Murray Saunders, Peter Goodyear, Paul Trowler, Peter Reimann, Roger Säljö, Rob Ellis, Maria Bannert.



Appendix 2: Recommendations to ALTC arising from Fellowship program experiences

I have had the opportunity to discuss aspects of the Fellowship project work, and broader issues of working as an ALTC Fellow, with a range of ALTC staff. These discussions have been useful to me, and, I hope, useful to ALTC. I want to pick just three areas for particular attention here.

1. ALTC Exchange

In Section 2, above, I mentioned the need for a broader conceptualization of how computer-based resources can improve teaching at the university level. In particular, I identified a need for tools that fit more neatly into teachers' actual work practices. ALTC Exchange works reasonably well as a repository of good ideas, links to exemplar material, etc. Its limitations stem in part from relatively slow take-up by the HE community. I am arguing that university teachers need other tools to help them do a better job of educational design: whether that is mapping intended learning outcomes to task designs, selecting/making available the mix of physical and digital resources students will need, or helping students work collaboratively. The analogy is with the computer-aided design tools (CAD tools) used by architects, product designers, et al. There is a body of work on the use of educational CAD tools in industrial training contexts, and there has been some exploration of the use of such tools in higher education settings. However, the tools readily available to teachers in Australian universities are very limited in number and functionality.

Recommendation 1: ALTC considers commissioning a scoping study for a flexible 'eCAD workbench' for university teachers and teaching teams.

2. Working strategically

My Fellowship started at what turned out to be a very difficult time for ALTC (then the Carrick Institute). The Carrick was facing severe budget cuts. A number of senior staff left. Others were understandably preoccupied by the threatening external environment. The Senior Fellowship scheme, as envisaged at the time I applied, included a residency period at Carrick HQ. By the time I started the Fellowship, this aspect of the scheme had been abandoned. This combination of events made it more difficult than needs to be the case for my work on the Fellowship program to align and tie in with other ALTC activities. Not all the Fellows will have the time or inclination to continue working closely with ALTC after the period of their funded program, but some will, and they represent a significant asset for ALTC and the higher education community more broadly.

Recommendation 2: There are a number of ways that Fellows could be more closely involved in ALTC's work – beyond the occasional fellows gathering – and I feel that some further attention should be paid to strategies for achieving this.

3. Promoting debate

In section 2, I drew attention to the limited number of channels available for stimulating serious public debate about teaching and learning in Australian higher education. At one or two Fellows' meetings, we discussed possibilities for Fellows, with organizational help from ALTC, teaming up to produce regular pieces on topical L&T issues – for instance, through an ALTC blog, with associated media releases. It's likely that only a minority of Fellows would have the time and inclination to contribute, but there are probably enough to make this worth a trial.

Recommendation 3: ALTC media staff consult with the Fellows to investigate the viability of a Fellows-led ALTC blog, with regular commentary on L&T issues.



Notes

- ⁱ Biggs, J. & Tang, C. (2007) *Teaching for quality learning at university: what the student does*, Buckingham, Open University Press.
- ⁱⁱ See e.g. Zhao, C.-M. & Kuh, G. (2004) Adding value: learning communities and student engagement. *Research in Higher Education*, 45, 115-138.
- ⁱⁱⁱ See e.g. Kennedy, G., Judd, T., Churchward, A., Gray, K. & Krause, K. (2008) First year students' experiences with technology: are they really digital natives? *Australasian Journal of Educational Technology*, 24, 108-22. Ipsos MORI (2008) *Great expectations of ICT: how higher education institutions are measuring up*. Bristol, JISC. The need to see technology as enhancing rather than replacing face-to-face learning opportunities was voiced in a number of submissions to the Bradley Review. (See *Review of Australian Higher Education, Final Report*, p211). Students' concerns about technology, contact hours, study time and access to teaching staff have also emerged as issues in studies and media commentary associated with recent inquiries into standards and practices in higher education in the UK. See e.g. House of Commons Innovation, Universities, Science and Skills Committee (2009) *Students and universities*. London, House of Commons. <http://www.publications.parliament.uk/pa/cm200809/cmselect/cmdius/170/170i.pdf> and Bekhradnia, B. (2009) *The academic experience of students in English universities*, HEPI. <http://www.hepi.ac.uk/downloads/40Theacademicexperienceofstudents2009.pdf>
- ^{iv} See <http://www.uq.edu.au/nextgenerationlearningspace/index.html> <http://www.jiscinfonet.ac.uk/infokits/learning-space-design/>
- ^v Knight, P. & Trowler, P. (2001) *Departmental leadership in higher education*, Buckingham, SRHE/Open University Press. See also Trowler, P., Saunders, M. & Knight, P. (2003) *Change thinking, change practices*. York, LTSN Generic Centre.
- ^{vi} I did not invent the term 'teaching-as-design'. It appeared, and began to settle itself in as a convenient label, during the early stages of preparation for the program. Googling the term, later in the program, revealed that it has also been used by Sarah Dinham (as early as 1988) – see Dinham, S. (1989) Teaching as design: theory, research and implications for design teaching. *Design Studies*, 10, 79-88. See also Brown, M. & Edelson, D. (2003) *Teaching as design: can we better understand the ways in which teachers use materials so we can better design materials to support their changes in practice?* Chicago, Northwestern University. Wallace, R. & Mishra, P. (2002) Teaching as design: Implications for learning to teach with technology. In Crawford, C. (Ed.) *Proceedings of Society for Information Technology and Teacher Education International Conference*. Chesapeake, VA, AACE. Recker, M. (2007) A study of teachers' use of online learning resources to design classroom activities. *The New Review of Hypermedia and Multimedia*, 13, 117-134. For a historical account of evolving conceptions of teaching, see Davis, B. (2004) *Inventions of teaching: a genealogy*, Mahwah, NJ, Lawrence Erlbaum Associates. Brent Davis coined the phrase 'ours is a teaching species'.
- ^{vii} Ellis, R. & Goodyear, P. (2009) *Students' experiences of e-learning in higher education: the ecology of sustainable innovation*, New York, RoutledgeFalmer. See especially chapters 8 to 10.
- ^{viii} The Faculty of Education at QUT is the largest in the country. Their patterns work can be viewed at <https://wiki.qut.edu.au/display/pam/Home> Cynthia Tate (USQ) and Wendy Fountain (UTas) gave a paper at the July 2009 HERDSA conference on teaching-as-design. Overseas, Ilya Zitter has recently completed a PhD at the University Utrecht (NL) developing some of my early ideas about design patterns in higher education.
- ^{ix} Gonzalez, C. (2008) Conceptions of, and approaches to, teaching online: a study of lecturers teaching postgraduate distance courses. *Higher Education*. Gow, L. & Kember, D. (1993) Conceptions of teaching and their relationship to student learning. *British Journal of Educational Psychology*, 63, 20-33. Kember, D. (1997) A reconceptualization of the research into university academics' conceptions of teaching. *Learning and Instruction*, 7, 255-275. Kember, D. & Kwan, K.-P. (2000) Lecturers' approaches to teaching and their relationship to conceptions of good teaching. *Instructional Science*, 28, 469-490. Pratt, D. (1992) Conceptions of teaching. *Adult Education Quarterly*, 42, 203-20. Samuelowicz, K. & Bain, J. (1992) Conceptions of teaching held by academic teachers. *Higher Education*, 24, 93-111. Trigwell, K. P. M. & Taylor, P. (1994) A phenomenographic study of academics' conceptions of science learning and teaching. *Learning and Instruction*, 4, 217-232. Virtanen, V. & Lindblom-Ylänne, S. (in press) University students' and teachers' conceptions of teaching and learning in the biosciences. *Instructional Science*.
- ^x Bligh, D. (2000) *What's the use of lectures?*, San Francisco, Jossey Bass. Crook, C. & Light, P. (2002) Virtualisation and the cultural practice of study. In Woolgar, S. (Ed.) *Virtual Society? - technology, cyberbole, reality*. Oxford, Oxford University Press. Schwartz, D. & Bransford, J. (1998) A time for telling. *Cognition and Instruction*, 16, 475-522.



^{xi} See e.g. Kuh, G. (1993) In their own words: what students learn outside the classroom. *American Educational Research Journal*, 30, 277-304. Kuh, G. (1995) The other curriculum: out-of-class experiences associated with student learning and personal development. *Journal of Higher Education*, 66, 123-155. Pascarella, E. & Terenzini, P. (2005) *How college affects students: Volume 2 - a third decade of research*, San Francisco, Jossey Bass.

^{xii} The caption to Figure 2 also reflects my belief that teaching as design is best approached as a collective activity, by teaching teams or at least by pairs of teachers, rather than by teachers flying solo.

^{xiii} "The fact is, more and more jobs – no matter what the title – are taking on the contours of 'knowledge work.' People at all levels of the organization must combine the mastery of some highly specialized technical expertise with the ability to work effectively in teams, form productive relationships with clients and customers, and critically reflect on, and then change, their own organizational practices. And the nuts and bolts of management – whether of high-powered consultants, or service representatives, senior managers or factory technicians – increasingly consist of guiding and integrating the autonomous but interconnected work of highly skilled people." (Argyris, 1998, p84-5) Argyris, C. (1998) Teaching smart people how to learn, *Harvard business review on knowledge management*. Cambridge, MA, Harvard Business School Press), 81-108. In a similar vein, Carl Bereiter, Seymour Papert, Allan Collins and others have argued that students need to experience authentic engagement with the dominant ideas of the time – that preparation for work in a knowledge society means that education must give students opportunities to engage in collaborative knowledge-building, to know what is involved in the improvement of ideas, and to move fluently between different areas of knowledge and ways of knowing. See Goodyear, P. & Ellis, R. (2007) The development of epistemic fluency: learning to think for a living. In Brew, A & Sachs, J. (Eds.) *Transforming a university: the scholarship of teaching and learning in practice*. Sydney, Sydney University Press.

^{xiv} Boulton, G. & Lucas, C. (2008) *What are universities for?* Leuven, League of European Research Universities. <http://www.leru.org>

^{xv} Mitchell, W. (1995) *City of bits: space, place, and the infobahn*, Cambridge Mass, MIT Press. Mitchell, W. (2004) Beyond the ivory tower: constructing complexity in the digital age. *Science*, 303, 1472-3. See also Goodyear, P. & Ellis, R. (2008) University students' approaches to learning: rethinking the place of technology. *Distance Education*, 29, 141-152. Crabtree, A. & Rodden, T. (2008) Hybrid ecologies: understanding cooperative interaction in emerging physical:digital environments. *Personal and Ubiquitous Computing*, 12, 481-493.

^{xvi} Bransford, J., Brown, A. & Cocking, R. (Eds.) (2000) *How people learn: brain, mind, experience and school*, Washington DC, National Academy Press. Sawyer, K. (Ed.) (2006) *The Cambridge handbook of the learning sciences*, Cambridge, Cambridge University Press.

^{xvii} For summaries of some foundational work in this area, see Goodyear, P. (1997) Instructional design environments: methods and tools for the design of complex instructional systems. In Dijkstra et al. (Eds.) *Instructional design: international perspectives*. Mahwah NJ, Lawrence Erlbaum Associates. Pirolli, P. (1991) Computer-aided instructional design systems. In Burns, H. et al. (Eds.) *Intelligent Tutoring Systems: Evolution in Design*. Hillsdale New Jersey, Lawrence Erlbaum Associates. Van den Akker, J., Branch, R., Gustafson, K., Nieven, N. & Plomp, T. (Eds.) (1999) *Design approaches and tools in education and training*, Dordrecht, Kluwer. Links to current work can be found in the *Annotated directory of design resources* that I compiled during the Fellowship project. (Available on the ALTC Exchange.)

^{xviii} Bloom, B. (1956) *Taxonomy of educational objectives* Boston MA, Allyn and Bacon. Biggs, J. & Collis, K. (1982) *Evaluating the quality of learning: the SOLO taxonomy* New York, Academic Press. Ohlsson, S. (1995) Learning to do and learning to understand: a lesson and a challenge for cognitive modelling. In Reimann, P. & Spada, H. (Eds.) *Learning in humans and machines: towards an interdisciplinary learning science*. London, Pergamon. de Jong, T. & Ferguson-Hessler, M. (1996) Types and qualities of knowledge. *Educational Psychologist*, 31, 105-113.

^{xix} Entwistle, N. & Ramsden, P. (1983) *Understanding student learning*, London, Croom Helm. Marton, F. & Saljo, R. (1976) On qualitative differences in learning I: outcome and process. *British Journal of Educational Psychology*, 46, 4-11. Marton, F. & Saljo, R. (1976) On qualitative differences in learning II: outcome as a function of the learner's conception of the task. *British Journal of Educational Psychology*, 46, 115-127. Prosser, M. & Trigwell, K. (1999) *Understanding learning and teaching: the experience in higher education*, Buckingham, SRHE/Open University Press.

^{xx} See e.g. de Botton, A. (2006) *The architecture of happiness*, London, Hamish Hamilton. Hall, R. (2002) Collaboration and learning as contingent responses to designed environments. In Koschmann, T., Hall, R. & Miyake, N. (Eds.) *CSCL2: carrying forward the conversation*. Mahwah New Jersey, Lawrence Erlbaum Associates.



^{xxi} Brown, J., Collins, A. & Duguid, P. (1989) Situated cognition and the culture of learning. *Educational Researcher*, 18, 32-42. Cobb, P. & Bowers, J. (1999) Cognitive and situated perspectives in theory and practice. *Educational Researcher*, 28, 4-15. Engestrom, Y. (1999) Situated learning at the threshold of the new millennium. In Bliss, J., Saljo, R. & Light, P. (Eds.) *Learning sites: social and technological resources for learning*. Oxford, Elsevier Science. Greeno, J. (2006) Learning in activity. In Sawyer, K. (Ed.) *The Cambridge handbook of the learning sciences*. Cambridge, Cambridge University Press. Lave, J. & Wenger, E. (1991) *Situated learning: legitimate peripheral participation*, Cambridge, Cambridge University Press. Oliver, R. & Herrington, J. (2000) Using situated learning as a design strategy for web-based learning. In Abbey, B. (Ed.) *Instructional and cognitive impacts of web-based education*. Hershey, PA, Idea Group Publishing. Pea, R. (1993) Practices of distributed intelligence and designs for education. In Salomon, G. (Ed.) *Distributed cognitions: psychological and educational considerations*. Cambridge, Cambridge University Press. Perkins, D. (1993) Person-plus: a distributed view of thinking and learning. In Salomon, G. (Ed.) *Distributed cognitions: psychological and educational considerations*. Cambridge, Cambridge University Press. Suchman, L. (2007) *Human-machine reconfigurations: plans and situated actions*, Cambridge, Cambridge University Press.

^{xxii} The idea of CAD tools for educational design is not a new one. There has been a history of R&D in this area, mainly in Europe and North America, spanning 20 years or so. See e.g. van den Akker, J., Branch, R., Gustafson, K., Nieven, N. & Plomp, T. (Eds.) (1999) *Design approaches and tools in education and training*, Dordrecht, Kluwer. eCAD tools in industrial and military training are reasonably well-established, but for a number of reasons there has been less interest and take-up in higher education.

^{xxiii} Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I. & Angel, S. (1977) *A pattern language: towns, buildings, construction*, New York, Oxford University Press.

^{xxiv} E.g. Gamma, E., Helm, R., Johnson, R. & Vlissides, J. (1995) *Design patterns: elements of reusable object-oriented software*, New York, Addison-Wesley.

^{xxv} Avgeriou, P., Papasalouros, A. & Retalis, S. (2003) A pattern language for designing Learning Management Systems. *European Pattern Languages of Programming (EuroPLOP) Conference*. Irsee, Germany. Fincher, S. & Utting, I. (2002) Pedagogical patterns: their place in the genre. *ITICSE'02*. Aarhus, Denmark. Goodyear, P. (2005) Educational design and networked learning: patterns, pattern languages and design practice. *Australasian Journal of Educational Technology*, 21, 82-101. Lyardet, F., Rossi, G. & Schwabe, D. (1998) Using design patterns in educational multimedia applications. *ED-MEDIA '98 Conference*.

^{xxvi} Ellis, R. & Goodyear, P. (2009) *Students' experiences of e-learning in higher education: the ecology of sustainable innovation*, New York, RoutledgeFalmer. See especially chapters 9 and 10.

