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Teaching as design

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This review paper draws together some ideas emerging from recent research and development activity in the field of 'design for learning'. It explores the argument that teaching in higher education will necessarily shift the balance of its efforts towards a greater investment in design, as a way of coping with otherwise intolerable pressures on staff and resources. It frames this argument by expanding the core conceptions of what teaching work entails and then focuses on some characteristic qualities of teaching as a design activity. Research relevant to 'teaching as design' intertwines issues that are of practical and theoretical significance. The scientific study of teachers' design work can be seen as falling into three main areas: design epistemology (or the study of 'designerly ways of knowing'), design phenomenology (the study of the products of the design process), and design praxiology (the study of the practices and processes of design). The paper introduces some examples of work in each of these areas and identifies areas that need further research. For practical purposes, the paper discusses ways of building design capacity within universities, through sharpening the focus on students' activity, and helping students to take greater control over the design of their own learning tasks and learning environments.

Keywords: *university teaching; learning design; design research.*

> … the function of teaching is to arrange—to design and implement—a context in which learning can flourish (Dinham, 1989, p80)

1. Teaching as design for learning: An overview of the argument

Broadly speaking, teaching work in higher education is of three kinds. There is 'interactive teaching'—when teachers and students are working together

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in real time. This is usually preceded by some kind of teacher planning activity and it is often followed by evaluative and reflective activity (Clark & Peterson, 1986, Moallem, 1998, Hativa and Goodyear, 2002). The evaluative and reflective teaching activity has twin foci. The teacher prepares feedback for students, e.g. through reading, marking and commenting on assignments the students have submitted. The teacher also reflects on the whole teaching and learning episode, and notes what they might do better next time. Ideally, the three phases form a loop, and the teacher's work thereby takes on a self-improving dynamic.

This paper explores the argument that teaching in higher education needs to find ways of investing more heavily in the planning phase and that teachers' planning needs to take on more of the qualities of *design for learning*. This is both an economic and an educational argument. In the 'drivers of change' section, below, I show that teaching traditionally—in the literal sense of teaching as one was taught oneself—is unable to cope with the changes now besetting higher education. Shifting resources towards design for learning, and adopting more effective design practices, is a credible strategy for improving the quality of higher education while managing with tighter funding. This applies at all key levels within the university. I will argue that spending more time on design will allow individual teachers and teaching teams to cope with intensifying pressures on the quality of their work, and to create better learning opportunities for their students. As a corollary, universities that find better ways of supporting the design work of their teaching staff will be well placed to meet the changing needs of students.

Design is not a panacea. Designers often get things badly wrong. But there is a steadily growing awareness within education that the established design professions have some methods for dealing with very complex issues, resolving conflicting requirements, reframing problems, and working with 'end users' (customers and clients; students) that are useful in educational practice (Krippendorff, 2006; Goodyear & Retalis, 2010; McKenney & Reeves, 2012; Kali, McKenney & Sagy, 2015). Moreover, crystallising good pedagogy into designed artefacts, such as courses, assessment tasks, videos, online tools and learning spaces, is also a way of turning recurrent expenditure (of time, effort, and cash) into durable assets.

The key challenge is to make universities more hospitable environments for design—to build design capacity among all staff (lecturers, professional staff and managers), and also to help students become more capable, self-managing participants in the processes that complete and enact designs for learning.

The paper draws on recent research that can illuminate the nature of this challenge and identify some areas in which forward movement may be most beneficial.

2. Teaching in higher education

Recent dramatic developments in the use of technology in higher education —notably the MOOCs phenomenon— have been accompanied by commentary that perpetuates the myth that universities still teach as they taught in medieval times. The dismissive line from those promoting MOOCs is strikingly consistent: Anant Agarwal, CEO of edX says "university teaching hasn't changed since the Middle Ages" (Hare, 2014).

> 'Education hasn't changed for 1,000 years', says Peter Levine, a partner with Andreessen Horowitz and a Udacity board member, summing up the Valley's conventional wisdom on the topic (Chafkin, 2013/2014)
>
> The way we teach hasn't really changed in millennia (Matthews, 2013)

While most lecturers do still lecture, the ways in which students study have been transformed—at least in the universities of the world's richer nations. Only a decade ago, most students in universities in North America, Europe and Australasia were not routinely bringing laptops to the campus (Ipsos MORI, 2008). Now, the majority of them carry some kind of tablet device or laptop around with them at all times. It is commonplace for them to view recordings of lectures on an iPad, at home or on the bus. It is common to download original research articles from online libraries. It is common to self-manage group-based projects, through mixtures of face-to-face meetings and social networking tools, like Facebook (Donlan, 2014; Henderson et al., 2015). Most universities now depend on web-based systems to make available to students all of the key information about their courses of study, assessment requirements, timetabling of sessions, ways of contacting teachers, etc. The availability of online resources has transformed the learning environment for students, expanding access to knowledge, information, data and people exponentially.

Lecturers still lecture. But there is also a growing awareness that the lecture has multiple functions—it has *never* been a simple matter of transmitting information. It is also a site for students to meet, to update their sense of how they are faring with the course, by picking up subtle cues from other students. It is a structuring resource: part of the spatio-temporal scaffolding that helps them do the work of being a conscientious student. It

is a place to watch experts think on their feet, improvise multiple explanations, give clues about what will come up in exams, reveal what they value, and, on a good day, share a passion.

Moreover, lectures are changing. The growing availability of video-recorded lectures is encouraging some teachers to experiment with how to make best use of the precious time when they and their students come face-to-face. Lectures become 'flipped' (for example see Herreid & Schiller, 2013) and learning experiences becomes 'blended' (Garrison & Vaughan 2008; Bliuc et al., 2007).

Given these changes in the use of lectures, and the larger transformations underway in the scale and richness of students' learning environments, it makes sense to adopt an expansive conception of teaching work—one which is not restricted to the emblematic activity of lecturing. Teaching can be understood as any activity which is undertaken with the intention of helping somebody learn. Teaching is not restricted to giving instruction. It also involves creating situations that are conducive to learning. In this sense, there is not an essential difference, only a difference in scale and complexity, between (a) a lecturer arranging chairs into a circle at the start of a seminar and (b) a multidisciplinary team of people creating a new learning hub, setting up a new learning management system, or revamping a degree program.

Teaching includes, but is not limited to, acts of explaining, instructing, advising and encouragement. It includes testing, marking and giving feedback. Therefore, it also includes deciding what to assess and how to assess it. It includes recommending things to read, and how to read them. More recently, it has come to include recommending additional kinds of resources, such as websites, recordings of lectures, online video clips and databases. In some disciplines or professional fields, teaching also involves organising lab classes, field trips, internships and other kinds of work placements. On occasion, it may also include suggesting to students that they should tackle a task in groups, or find a peer to give feedback on a draft assignment, or think of themselves as apprentice members of a professional community. Teaching work can also include a distinctly *material* dimension. For example, when teaching a lab class, a chemistry lecturer will need to be sure that adequate supplies of the right chemicals and apparatus are available. This materialist dimension of teaching can manifest itself in a variety of ways. Some teachers take great care about the placement of chairs in a seminar room, to encourage equitable participation in discussions. Lecture rooms need to be big enough to seat all students, but they also need good acoustics, or a public address system, or the lecturer needs to

change their mode of delivery and project their voice. The text on PowerPoint slides needs to be big enough to read—a function of the depth of the room and the throw of the projector, resolved in the lecturer's choice of an appropriate font size.

Clearly, teaching involves much more than exposition. Like learning, it is an activity in which the social and the material— not just the epistemic—are consequential. Some careful forethought, imagination, empathy and planning will often tilt the balance towards success. As many experienced teachers will know, when it comes to planning educational activities, the devil is often in the details: small oversights can have disproportionate effects on how a learning activity unfolds. Lack of attention to detail in the planning can sometimes be remedied by quick thinking and improvisation in interactive teaching, but getting the devil out of the detail soon becomes a preoccupation for the teacher who wants to minimise risk and anxiety.

None of this teaching work *necessarily* evokes the idea of design—of seeing a significant part of the teacher's work as design-like. Indeed the term 'design' does not have much currency in the core practices of higher education, outside the disciplines which teach design and in the work of instructional/educational designers (Keppell, 2007; Ellis & Goodyear, 2010, Chapter 8; Luckin, 2010; Laurillard, 2012; Conole, 2013; Gibbons, 2013).

The word 'design' does sometimes crop up in conjunction with courses, curricula and assessment, but the practices to which it refers, in these cases, do not often have the defining qualities that design researchers normally associate with design (Cross, 2006; Krippendorff, 2006; Farrell & Hooker, 2013). For example, the framing of problems is not routinely questioned, and analysis all too often proceeds hastily to implementation (Fraser & Bosanquet 2006; Hoogveld et al., 2002; O'Neill, 2010; Stark, 2002). This rush to implementation has at least two drivers. A teacher who doesn't have a sense of design as a process, and who doesn't have the conceptual tools and skills to work through a design problem in a creative but structured way, will be likely to jump straight to a solution. Also, being submerged in the taken-for-granted assumptions of both a disciplinary tradition and a teaching tradition can make solutions look deceptively self-evident.

3. Teaching as design

This expansive conception of teaching conjures up an image of teaching work as multidimensional. As already noted, there is a temporal dimension, in which there are:

- interactive forms of teaching that involve real-time exposition and other kinds of direct instruction, as well as facilitation of students' learning activities
- pre-active forms of teaching: planning, design etc.
- post-active forms of teaching: reflection, evaluation, assessment.

Teaching as design is therefore part of pre-active teaching, and can be seen as a subset or type of planning—as planning that uses a distinctive mode of thought and set of tools and methods. However, design is probably most powerful when conceived as the intelligent centre of the whole teaching-learning lifecycle. For example, design can, and probably should, include (re-)designing evaluation instruments that are specifically tuned to picking up exactly the right kind of data to feed the next round of design decisions (Goodyear & Dimitriadis, 2013; Dimitriadis & Goodyear, 2013).

In relation to teaching as design, there are three main classes of things which can be designed: (i) good learning tasks, (ii) properly supportive physical and digital environments, and (iii) forms of social organisation and divisions of labour.

And each of these classes of designable things, or 'design components', needs to be thought of, designed and managed, at multiple scale levels, by different people who contribute from different roles and positions within the organisation. Hence, design of a reading list sits within the design of a library collection; design of an assessment task sits within the design of a course, which sits within the design of a degree program and a set of university-wide generic graduate attributes. Design for groupwork sits within designed social structures, such as courses and cohorts.

Two final points should be made about this design activity: (i) it works indirectly—students adapt, interpret and customise, (ii) it rarely involves the creation of brand new things—more often, it involves selections of existing things and their configuration into new assemblages. (Which is also true of design in other fields.)

Figure 1 (adapted from Goodyear & Ellis, 2008) helps pin down the essence of this view of teaching as design. It portrays design as having an *indirect* effect on student learning activity, working through the specification of worthwhile tasks (epistemic structures), the recommendation of appropriate tools, artefacts and other physical resources (structures of place), and recommendation of divisions of labour etc. (social structures).

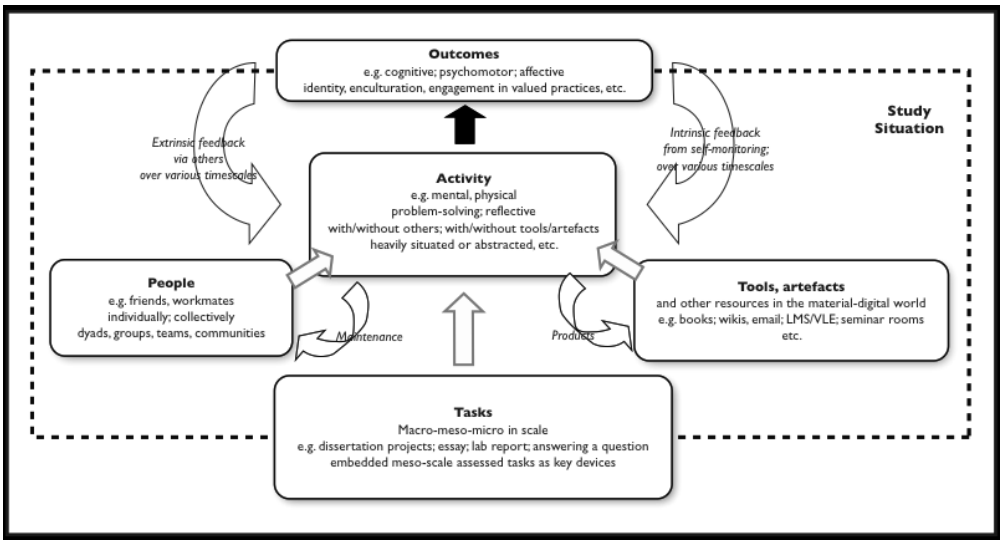

Figure 1: Activity-centered design model

This is an *activity-based*, or *activity-centric*, view of learning. It prioritises what the students *do*: including what they think, feel and say. As John Biggs (1999a) reminds us, what students do is consequential for their learning. John Biggs has remained properly insistent about this focus on 'what the student does' which is also the subtitle of his highly influential *Teaching for Quality Learning* book (Biggs, 1999b; Biggs & Tang, 2007). Biggs acknowledges Tom Shuell as the inspiration for this phrase.

> "… what the student does is actually more important in determining what is learned than what the teacher does" (Shuell, 1986, p429).

Everything else is merely a stimulus or scaffold for their activity. Most of the work students do—much of their learning activity—takes place without direct supervision from their teachers. Hence, teachers need to design good learning tasks and to communicate task specifications clearly to their students. Because design works indirectly—students normally *interpret* task specifications, rather than following them blindly—designed tasks need to be understood as resources for activity, not determinants of it. And because activity is both physically and socially situated, teachers are under an obligation to help students locate, access and configure the physical resources they need for the activity in which they are engaging and to help them find good ways of working with their peers (e.g. in pairs, T-groups or communities of practice).

This conception of teaching as design touches some deep themes in the organisation of collective human life. Teaching is a moral activity that

intentionally shapes what other people do, in order to help them learn—which, in turn, shapes their future actions, capabilities, dispositions, ways of comprehending themselves and the world, and so on.

To appreciate the full import of this point, it helps to reflect for a moment on structure and agency. What people do is often best understood as an interplay between structure and agency (Giddens, 1984; Archer, 2000, 2007). People's action can be thought of as a self-directed journeying through a pre-existing landscape. Sometimes the landscape is flat and affords walking in any direction one chooses. Sometimes, the tilt of the land keeps surreptitiously edging one's feet downhill. Sometimes one can only walk where safe paths have been trodden by others. The landscapes within which activity unfolds are constituted by economic, social and political forces, as well as material realities. Or rather, the landscape is itself formed through the actions of people and things, over longer and shorter spans of time (Ingold, 2000, 2011).

On this view, one of the ways that teaching can take place is through shaping the landscape across which students walk. It involves the setting in place of epistemic, material and social structures that guide, but do not determine, what students do. There is a beguiling recursiveness to this conception. The aim is not just to shape landscapes (learning environments, if you prefer) that help students become more capable agents—it is not just about increasing their personal agency. While this is important, it is also important to help students read the landscape and learn to (re)shape landscapes for their own future activity, and for the activities of others, including for future learning.

This is an *old* form of teaching. For example, creating environments in which the young can learn by observing their elders performing important activities—making places that are congenial for learning mimetically—has played a very powerful role in human cultural evolution. Kim Sterelny (2003, 2012) provides a very readable account of this process in early human history. Stephen Billett (2014) analyses the history of mimetic learning, especially in relation to learning for trades and other occupations.

4. The essence of design

There is a sizeable body of research on teachers' planning, including planning by university teachers (Eley 2006; McAlpine et al, 2006; Stark, 2002). However, planning and design are not the same thing. Design entails planning, but (a) it involves more than planning and (b) it introduces some distinctive kinds of problems and ways of handling them. Much of the rest of

this paper reviews aspects of research on design (for learning). As a preamble, it will be helpful to pin down some distinctive characteristics of design.

Design typically results in the creation of specifications of some kind, rather than directly in a finished product. It produces blueprints, plans, sketches: inscriptions of various types, that guide the creation of an imagined end product. Etymologically, 'design' relates to both 'making marks' (drawing) and 'marking out' (designating; giving significance to) (Krippendorff, 2006).

Many design practices, including the emblematic areas like architecture, are oriented to the (eventual) creation of material products: simple or complex. In recent years, *service design* has become more widely practiced (e.g. in the design of public services) (Boland & Collopy 2004; Meroni & Sangiorgi, 2011). Design for learning is a hybrid, involving mixtures of service, product and space design. This hybridity is accompanied by a need for a more complex knowledge-base for design than is sometimes found in discussions of knowledge for university teaching (see Design Epistemology section, below).

Design normally involves rapid generation of large numbers of possible solutions—not just rapid prototyping but design experiments of various kinds. Allan Collins and Ann Brown can be credited with the idea of bringing design experiments into the repertoire of educational researchers (Collins, 1990; Brown, 1992). As such, they are often cited as inspiring the design-based research (DBR) movement. There has been some slippage in the translation process, however. The range of activities that product designers and architects call 'design experiments' is larger and serves a wider set of purposes than we find these days in DBR. In these more established design professions, design experiments can be cheap and small-scale. A very important function of this mode of working is to *test and expand the understanding of the problem*. Reframing the problem, for example by seeing the problem as a symptom of some larger problem, is a classic design move.

Design usually entails resolving tensions between competing objectives. It is intrinsically complex because of this. (In contrast, classic introductions to instructional design assume that it is primarily a matter of optimising instruction for a single, simple goal). In higher education, for example, we often work with multiple intended learning outcomes for any one learning activity, and these outcomes are often in competition, if only for the student's time and attention. For example, a learning activity may simultaneously involve coming to understand a Physics principle, learning to work with others and becoming better at managing one's own learning.

Optimising for just one of these can imperil the others. Because of the complexity involved in balancing competing objectives, and the inherent difficult of determining optimal solutions, design is characterised as a space of 'wicked' problems (Rittel & Webber, 1984; Farrell & Hooker, 2013).

Design sometimes leads to the creation of a fixed product, offered to consumers in a 'take it or leave it' spirit. More often, the designer's work is seen as being taken over by others on a path or lifecycle. In recent times, this process of consumers or end-users taking over, reconfiguring, adapting, personalising and embellishing designed products has been given wider recognition in the design community—there is now a stronger sense of co-production or co-configuration, with a concomitant sense of design as being fundamentally a communicative process (Krippendorff 2006). This is discussed further below in reference to the semantic turn in design and the involvement of students in co-configuring their own learning environments.

5. Drivers of change: Challenges for traditional teaching

It is one thing to advocate for a more 'designerly' approach to university teaching; quite another to explain why it is likely to become more salient in our future work. Figure 2 is an attempt to portray forces that are challenging the capacity of universities to continue to teach in traditional ways, by which I mean through teaching practices that are copied from one generation to the next.

Figure 2 highlights four sets of forces that are having a powerful effect on contemporary higher education. (1) In the shift from elite to mass higher education, students' needs and expectations are diversifying and the educational and logistical demands being made of universities are becoming harder to meet. (2) Employers and their representatives are continuing to criticise universities for failing to produce work-ready graduates. Students themselves are questioning whether they are getting a fair return on the time and fees they are investing. (3) The technologies being used in knowledge work—for research and teaching and in other areas of intellectual life—are changing rapidly. New knowledge practices are emerging, such as those involving data analytics, visualisation and very complex forms of computational modelling. The pace of technological innovation is accelerating. This creates risk and uncertainty for university managers, especially with respect to campus planning, IT and educational strategies in the longer term. (4) Dwindling public funding of teaching, as well as competing demands on time—for research, service, entrepreneurial activities, etc.—are intensifying the pressures on teaching staff.

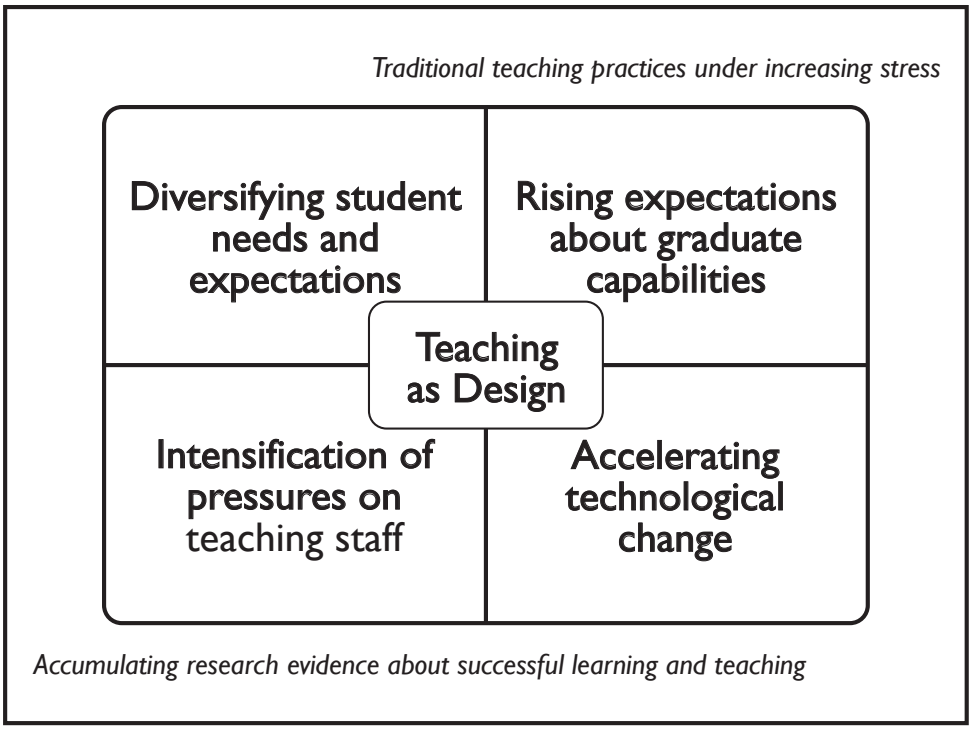

Figure 2: Drivers of change: 'teaching as design' as a means of resolving conflicting forces shaping contemporary higher education

These four sets of forces combine to place traditional teaching practices under stress. That is to say, teaching approaches that may have been the norm 20 or even 10 years ago no longer look affordable or appealing. The reproduction of past teaching practices—passing on disciplinary traditions intact—is unsustainable in a rapidly shifting environment: it is no way to deal with change. Coupled with this, there is an accumulating body of research-based evidence about successful learning and teaching that at least questions, and sometimes condemns, the apparent good sense of some past practices.

Placing 'teaching as design' at the centre of Figure 2 is a way of asserting that evidence-informed, creative, design-based strategies will be needed if universities are to generate innovative repertoires of educational approaches to deal with, and ideally to anticipate, changes in their operating environments. This assertion means much more than employing greater numbers of better-trained educational designers, useful though this should be. It means making universities more design-savvy; helping everyone in the institution participate in knowledgeable, design-led change.

For universities to become more congenial homes for design, managers and other staff need a sharper, shared understanding of what is special about

design. Consequently, the next three sections of this paper look more closely at research relevant to building design capability within universities. They are structured using Nigel Cross's (2006) partitioning of the science of design: *design epistemology* (the study of 'designerly ways of knowing'), *design phenomenology* (the study of the form and configuration of designed artefacts), and *design praxiology* (the study of the practices and processes of design).

6. Design epistemology: actionable knowledge for design

The knowledge needed to design, in education as in other fields, is *actionable knowledge*: that is, knowledge that is sufficient to inform action in the world. Unlike (educational) researchers, who can remain perpetually equivocal about the status and sufficiency of what is known through research, teachers and designers *must* make decisions, usually on the basis of fragmentary, heterogeneous and uncertain knowledge. Their work practices are framed by unmissable deadlines—courses, materials, assessment tasks, rooms etc. have to be ready by a fixed date. They have a moral obligation to act, in the best interests of their students. Ellsworth puts this well, contrasting the situations of a scientific researcher and a judge in court,

> Science demands no final decision; it is an ongoing process. If the evidence is murky, scientists can wait, can reserve judgement until they can conduct further research. And they can figure out what further research needs to be done to answer the question, and do it. Judges can neither reserve judgement nor go beyond the data presented in court, however ambiguous those data might be. They cannot carry out further research, nor wait until others have done so; they must decide. (Ellsworth, 2005, p696).

This brute fact, that designers are caught up in the world of action and have an imperative to act, within a certain timeframe and on the basis of imperfect knowledge, has implications for their use of knowledge and for the kinds of knowledge that are most use to them. Crucially, a designer needs to understand the extent of their freedom to act: what can be changed and what is unchangeable? A common design tactic is to reframe the problem as presented, to see whether a more radical approach to a design solution might actually be better. It is sometimes argued that design in educational settings is more strongly constrained by existing practices, limited resources and risk-averse regulatory systems than is design in some other fields. It is also likely that a design anthropologist from Mars would

not be able to infer the intended functions of what they find to have been set in place in our universities. So the designerly aspects of university teaching work are seriously and strangely constrained.

What this means for knowledge for teachers as designers is a complex story, of which the chief points are as follows:

Research-based knowledge of the kind that emanates from the *critical* traditions is useful as a way of sensitising the teacher-designer to the forces shaping the landscape within which their work is set, and can be a valuable part of their moral education. That said, research from a critical tradition does not connect smoothly with the needs of a teacher-designer who is trying to make the best of things in compromised circumstances.

Design involves making invitations to other people to act in certain kinds of ways. These invitations can be clear and explicit, but they are sometimes encoded into the affordances of materials. Designers' knowledge has to include ways of predicting, or at least imagining, how other people will respond to these invitations. Areas of the human sciences which produce such second-order knowledge are particularly valuable. These include, but are not limited to, various branches of psychology, anthropology, ergonomics and economics.

The design of *scaffolding* is a crucial aspect of design for learning. Thinking about the schema in Figure 1, students' activity is only in part a response to a written or spoken task. What they do, moment-by-moment, is also influenced by features of their task environment and a key success factor can often be found in the interplay between (a) a clearly expressed task and (b) subtle scaffolding that allows the students to focus their scarce cognitive resources on the core of the learning task, rather than on worrying about what they will have to do next. This can be hard to judge, at design time, but it is vitally important when one is aiming to promote active learning among large student groups with inadequate staffing—such as when there are not enough facilitators to repair poor designs interactively at 'learntime'. Two kinds of knowledge are needed for the design of good scaffolding: (i) a psychologically-informed understanding of why scaffolding strategies are needed and how they work, and (ii) discipline-informed experiential knowledge of what scaffolding will be most appropriate when. This is a subset of pedagogical content knowledge—see, for example, van Driel & Berry, 2011.

Being able to anticipate how learning places, tools and other artefacts will fit together and interact depends upon forms of knowledge and ways of knowing that are characteristic of the physical sciences (≈positivist). Being able to anticipate how students will respond to learning tasks and learning

environments depends upon forms of knowledge and ways of knowing that are characteristic of the human sciences (≈interpretivist). Consequently, designing (for) complex assemblages of humans and things requires an epistemic fluency that is rare, indeed sometimes frowned upon, in educational practice (Goodyear & Zenios, 2007; Goodyear & Ellis, 2007; Goodyear & Markauskaite, 2009; Markauskaite & Goodyear, forthcoming).

> … architecture has sometimes found ways of getting on with the job when education freezes in the headlights of epistemological or moral uncertainty. Educationalists talk about the dangers of combining contradictory epistemological positions … while architects combine ideas from mechanics, optics, acoustics, economics, aesthetics, human biology, social psychology and history. They can combine mathematics and astrology without blushing. They build terrible buildings and some great ones. They sometimes ignore crucial human needs and wants, but the best of them do tend to show an understanding of human nature and its relationship to the material world that is subtle and profound. (Goodyear, 2011)

Finally, there is a kind of meta-knowledge about design that is important for situating design in the evolving circumstances of higher education. To make the point briefly, one can think of two contrasting conceptions of design, which I will label 'the organic' and 'the strategic'. By organic design, I mean processes that are endogenous to an evolving system, whereby change occurs through multiple local enhancements that are typically the work of the inhabitants of the system. This might also be labelled 'bottom up' design. It is well-described from both a theoretical and practical perspective by Christopher Alexander and Tim Ingold. Christopher Alexander has written on this topic, in various ways, since the mid-60s. Books that can be strongly recommended to those interested in design for learning include his works aimed at democratizing architecture and urban planning (notably Alexander, 1979; Alexander et al., 1977, 1987), as well as his works that deal directly with campus planning and university architecture (Alexander et al., 1975, 2012). His foundational work on order in natural and built form is best approached in Alexander (1964) and Alexander (2006). Alexander's work on design patterns and pattern languages has been used and misused in areas as diverse as human computer interaction, community development, software engineering, school architecture and educational technology (Goodyear & Retalis, 2010; Nair et al, 2009). The anthropologist Tim

Ingold's thinking about design as a locally unfolding process is best summarised in Gatt & Ingold (2013).

While there are good reasons to value well-informed, inquisitive local design, not all problems are amenable to local, organic solution—especially when systems become grossly distorted by external pressures such that internal capacities for generating workable responses are compromised. In such cases, a more strategic intervention may be needed. The key point here is that knowledge for design needs to help distinguish between situations where organic design is working well and situations where more strategic design is necessary. The movement known as 'design based research' (DBR) combines elements of both the organic and strategic. Typically, design based research imports researchers' ideas into a specific educational setting and researchers then work in partnership with teachers (the local inhabitants) to develop, test and refine successive iterations of an intervention (Cobb et al., 2003; Reimann, 2011; McKenney & Reeves, 2012). That said, the DBR literature is surprisingly quiet about design itself.

7. Design phenomenology: what gets designed

Design phenomenology is the subfield of the scientific study of design that focuses on the nature of the products of the design process. This goes beyond the form and configuration of designed artefacts (Cross's original definition). Indeed, one of the goals of design phenomenology, when higher education is the application area, is to identify the scope of what can and should be designed.

First and foremost, *learning* cannot be designed. Neither can activity or experience be designed. They can be *designed for* (Wenger, 1998).

Second, as suggested earlier, an activity-centered approach to teaching and design that acknowledges the physically and socially situated nature of students' learning activity will focus on three main design components that come together at 'learntime' (Figure 1). While they entangle in students' actual learning activity, they are best kept conceptually distinct in parts of the design process. This acts as both a reminder—to attend to all three of the components: epistemic, physical and social—and as a way of maintaining flexibility to shift elements of a design solution from one component to another. For example, if the specification of a task (epistemic) begins to look over-complicated, it may be possible to offload parts of it to scaffolding which is provided through supportive digital tools or artefacts. Or if the teacher-designer begins to worry that a piece of groupwork may go awry, then they can supplement the social design (e.g. forming project teams of

four people) with some additional instructions about how to co-ordinate work (i.e. they can elaborate the task specification). In analysing what then takes place in the learning activity, part of the intellectual challenge is untangling the interacting elements in order to map them back into the (re)design process for the next cycle of the course.

Third, what gets configured into a design varies in scale and complexity: from a brief in-class task to a whole degree program; from a lab book to a library; from a dyad to a cohort.

Fourth, what is designed is acknowledged by the designer to be open to transformation by the students who are the 'users' of what has been designed. In some situations, such as those where serious risks for others may eventuate if student activity strays from what is intended, it may be important to 'lock down' the design, minimising scope for accidental variation. But in many higher education situations, we *want* students to appropriate what is designed. Klaus Krippendorff (2006) talks about the 'semantic turn' in design, arguing that conceptions of design must shift from thinking about the surface appearance of fixed material objects to the creation of artefacts (social, material or conceptual/epistemic) that have a chance of meaning something to their users. Successful designs are those which come to fruition through the help of many people; learning environments are co-configured and learning activities and outcomes co-produced.

This is part of what allows students to make a task personally meaningful, and/or improve its alignment to their personal needs and interests. It is also an important enabler of students' increasing ability to manage their own learning, encouraging them to sharpen the definition of learning tasks, enrich their social and professional networks and configure their learning environment to better suit their needs. One can think of this as a socio-material expansion of the idea of metacognition or self-regulation.

8. Design praxiology: Studying what designers do

There is a small but growing body of empirical research into what people do when they are designing for other people's learning. Ertmer, Parisio and Wardak (2013) provide a good, recent overview. Much of this research focuses on professional educational/instructional designers. But there is also a thin strand of inquiry focused on the design activities of university teachers, sometimes comparing their design strategies and design thinking with the strategies and thinking of experienced, professionally-trained educational designers (Moallem, 1998; Hoogveld et al 2002; Kirschner et al

2002; Ertmer et al. 2008, 2009; Bennett et al., 2009, 2015; Goodyear & Markauskaite 2009; Kali et al 2011, 2015). Supplementing this are the insights that come as a by-product of evaluation studies carried out to test novel design tools and methods (Masterman et al 2009; Conole 2013; Prieto et al., 2013).

Within this pool of empirical material, there is actually very little work that provides a close look at how higher education teachers engage in design processes, particularly when they are doing so in their habitual ways, rather than for the purposes of an experiment. Our current best insights come from:

- interview-based studies that ask teachers about their design activities, though these studies are subject to all the usual restrictions of first-person accounts of activity. Recent outcomes here align with earlier research on ways that teachers think when they are more generally involved in course or curriculum planning: thoughts are focussed by teachers' beliefs about their students, what their students will and won't enjoy, and by pragmatic constraints of the teaching and learning environment See for example Ellis et al (2009), Bennett et al (2015).
- experimental studies in simulated design studio environments, which allow close observation and debriefing interviews with teacher-designers, but which are weak on ecological validity. Recent outcomes here have provided some useful warnings against imposing design methods or tools that lead to premature formalisation of designs. See for example Thompson et al (2013).
- some rare naturalistic observational studies that focus on discourse in design meetings. Insights here relate mainly to the development of shared epistemic agency in multidisciplinary design teams, tracing the ways in which teams move towards design solutions by incorporating each other's design insights (Kali et al 2011).

This area—studying university teachers' existing design practices and identifying ways of enhancing those practices—is wide open for further investigation. So too is research into the ways in which other university staff who support student learning engage in design activities.

9. Capturing, sharing and reusing design ideas

Teachers in higher education have been notoriously reluctant to use other teachers' educational products, though there are some signs that ease of

access to burgeoning online resources is helping shift this cautious position. It may be that the time-cost of reviewing resources created by other teachers was a significant barrier, prior to the growth of easily searchable online collections of fine-grained teaching materials. It may also be that this is another area where the pressure of students' changing practices and expectations has made more conservative positions untenable. Laurillard (1993, 2012) and Conole (2013) provide a sense of the history here.

Against this background, R&D aimed at making it easier for teachers to capture, share and re-use design ideas, rather than finished resources, has had rather limited success. People have been working on this area for more than 40 years (Pirolli, 1991; Goodyear, 1997; Conole, 2013; Maina et al., 2015). It may turn out that the growth in reuse of learning resources that we are currently witnessing will spill over into the area of reusable designs, especially if the recent shift in attention to the actual needs and working practices of teacher-designers bears fruit. Among the more promising areas are (i) (runnable) computer-based designs for learning activities, such as one finds with the Learning Activity Management System (LAMS) (Dalziel, 2007), and (ii) pedagogical design patterns and pattern languages (Laurillard, 2012; Goodyear & Retalis, 2010; Mor at al., 2014).

10. Conceptions of learning and design

Much of the writing about design for learning in higher education implicitly or explicitly adopts what Anna Sfard (1998) labelled the 'acquisition' metaphor for learning. That is, learning is seen as something which results in the personal acquisition of knowledge and skills. Rather less attention has been paid to other conceptions of learning, such as 'learning as participation' or 'learning as knowledge creation' (Paavola et al., 2004; Moen et al., 2012).

This is very significant for conceptions of 'teaching as design' because the relations between (a) what can be designed (what is set in place) and (b) students' situated activity, differ substantially for each of these conceptions of learning. For example, if learning is seen as a matter of acquiring knowledge, then tools which are set in place for students are there to help them acquire that knowledge: they are solely a means to that end. But if learning is seen as primarily a matter of participating in a social practice, tools are there to be mastered, as instruments *of* that social practice. If learning is seen as a matter of collaborating in knowledge creation, then new tools are designed and created by students, as a legitimate outcome of their work.

All three metaphors are valuable. So teachers need an expansive, nuanced conception of students' engagement *in* design (Allert et al., 2014). Part of graduating as a lifelong learner is knowing how to design for one's own learning, and for the learning of one's workmates: learning how to create better environments in which to think for a living.

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I would love to be able to lay claim to the phrase 'teaching as design' but Google makes us all more honest and humble scholars. I believe the term was first used by Sarah Dinham in 1989. See also Wallace & Mishra (2002), Brown & Edelson (2003), Recker et al. (2007). I first employed it in 2007, in the context of my ALTC Fellowship.

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