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Design research

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Abstract

This paper advances an argument for 'design research' as a core approach to developing useful knowledge for health education and training. Design research is research that is intended to produce actionable design knowledge: in our case, knowledge that can be used by people who are involved in designing for other people's work-related learning. Design research includes understanding how design is actually accomplished (its working practices, tools, methods, capabilities of the people involved, etc.) and understanding how local learning systems function. A richer and more realistic sense of how design is done is of great practical use. It can guide other aspects of the production of knowledge that will be useful to designers. Educational and training interventions tend to be complex and learning is often diverse and messy. Understanding the internal dynamics of local learning systems is useful to those whose job it is to improve their functioning. Analysis of this kind can also stimulate reflection on the why and how of design: design teams learn a great deal about the systems in which they are meshed. The paper ends with some thoughts about how organisations and journals can help to capture and share these lessons learned.

Keywords: design research, design knowledge, epistemic fluency

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In this article, I argue for a shift in how we frame research that is intended to inform and improve education and training in the health sector.

Over the last 20 years or so, I have been pursuing three connected lines of investigation. The first is concerned with professional knowledge and especially with the relationships between knowledge and action in the workplace (see e.g., Goodyear 1995; Markauskaite & Goodyear 2017). The second has been developing ways of analysing complex learning situations, to understand the 'architecture' of successful learning environments (e.g., Goodyear 2000; Carvalho & Goodyear 2014). The third focuses on design for learning: how people who are professionally involved in designing for other people's learning do what they do; what knowledge, tools and methods they use, and how their efforts might be strengthened (e.g., Goodyear 1997; Goodyear & Dimitriadis 2013; Goodyear 2015).

The shared insights from this program of work have led me to believe that it is time to push for some different ways of conceiving of the creation of useful knowledge in educational research and practice. *Design for learning* takes a central place in this conception. The real-world practices of design for learning provide a focus and timeframe for knowledge creation: actionable knowledge that flows into design practices can thereby have a significant effect on educational outcomes. This is not a radically new line of argument. It echoes what some people have been advocating for a while in areas such as formative evaluation and action research (Pawson & Tilley 1997; Penuel 2014; McConnell 2002; Laurillard 2008). But it goes further, by arguing that the complexity of many contemporary learning situations and workplaces needs us to take *design* much more seriously: to understand it better and to organise design work so that it can more easily draw upon an appropriate array of knowledge sources.

The argument starts with a caricature: a deliberate over-simplification intended to highlight a problem. There is an endemic educational pathology which is quite easy to recognise but rather harder to pin down. It presents as a fad, spreads by contagion and dies out when starved of resources by a new fashion or the lassitude of its victims. The flipped classroom is a recent example. Earlier instances include blended learning, e-portfolios, reflective practice and PBL.

There is nothing intrinsically wrong with any of these educational approaches. The problem lies in how they are understood, motivated, sustained and let go. Evidence of educational effectiveness rarely plays a central role in any of these issues of take-up, implementation and abandonment. Admittedly, most such approaches are accompanied by research – scholars have published thousands of papers on blended learning and PBL in the last decade alone. But it is very rare to find major educational innovations spreading on the basis of robust evidence (Bassir et al. 2014; Ahmadi et al. 2015; Betihavas et al. 2016; Wosinski et al. 2018).

For one thing, remarkably few empirical studies of innovative practices succeed in measuring specific learning gains (or even set out to do so). Measuring student satisfaction is much more common than measuring learning gain; but this only tells us that students are not unhappy about the innovation foisted upon them. It says little or

nothing about whether they have learned what they were intended to learn. Students are sometimes asked to report on the effectiveness of their own learning, though the literature tells us that they are often poor judges of how successful their learning has been (Kirschner & van Merriënboer 2013). Even where careful measurements have been made – before and after an educational intervention – of what students know or can do, it is rarely the case that the intervention is described in sufficient detail that it can be replicated elsewhere. In short, it is a wonder that we manage to educate anybody, whether in the health workforce or more broadly.

Rather than give in to despair – which would be the wrong stance to take in the first issue of a new journal – I want to argue for a fresh start. The fact that (most) people do manage to learn (most of) the things they need to learn in order to practice safely and effectively is a phenomenon to be researched and more widely understood. There are no grounds for complacency, but we need to acknowledge that health education and training keep on keeping on, with few crises, and research into professional education and training struggles to keep up with practice. In particular, there is a daunting gap between the best of what is written about professional learning and capability, on the one hand, and actionable knowledge for educational and training design, on the other. Some of the best recent work on theorising how effective professionals do what they do is yet to feed forward into design for learning. But also, some of the best educational design work goes under the radar: it is undocumented, hard to share, hard to build upon and does not feature in academic descriptions of how design work is, or should be, done. Educational design teams learn a lot during every major project, but this learning and its outcomes rarely get the attention they deserve.

This has long been a weakness in design practice more generally – in areas such as architecture and product design. In a recent review, Clive Dilnot quotes the celebrated American designer Jay Doblin:

> **'Although I designed hundreds of successful products for major corporations, it suddenly occurred to me that I didn't understand what I had been doing.'**

According to Dilnot,

> **'Design was done, but it was not *thought*. Design was without reflection. Indeed, it was all but ordered that it should be so.' (Dilnot 2018, p. 142, emphasis added.)**

Dilnot goes on to explain how research into design was actively resisted, in both design firms and design schools. A version of this also manifests itself in educational research: there is more interest in the 'what' than in the 'how' and 'why' of design.

So part of the challenge facing us is to turn new research on professional capability and learning into actionable knowledge for design. Another part is to describe design practices and outcomes in ways that render them shareable within a broader community of designers. These two parts of the intellectual enterprise can be brought together to form a core for what the design theorist Ezio Manzini calls '*design research*: an activity capable of producing knowledge useful to those who design. That is, *design* knowledge.' (Manzini 2015, p. 38, emphases in the original.)

SCOPING DESIGN RESEARCH

Design research in the field of health education and training needs to encompass the production of design knowledge that is useful to those who design for other people's (professional) learning. Design research cannot be undertaken rationally without a good understanding of how designers take knowledgeable action. In other words, how designers actually design is a valuable *object* of research. As a significant educational sub-community, we need to know more about real-world design practices in our area and how various forms of tacit and explicit knowledge actually feature in designers' work (Kali, Goodyear & Markauskaite 2011; Tracey & Baaki 2014; Svihla & Reeve 2016; Bennett, Agostinho & Lockyer 2017). Formalised design methods, such as ADDIE, and design tools, such as templates or patterns, need to be understood as resources that are bound up in actual design practices, rather than as descriptions or indicators of how design work is really done. That is, we need to know more about how the 'approved' ways of doing design actually figure in the reality of design work. Another way of putting this is to say that we need a better understanding of the actual needs and capabilities of real 'end users' of design research: people who design.

For example, Rebecca Udemans and colleagues have recently published a summary of the approaches taken by the Royal Australasian College of Physicians in renewing its speciality training programs (Udemans et al. 2018). They describe co-design and the management of multiple interacting elements of a complex intervention as two important aspects of the work. Co-design involved close interactions with a range of knowledgeable stakeholders: physician leadership of a process in which (re-)design work was accomplished through a combination of educational expertise and timely contributions from trainees, supervisors and others. This implies a particular model for design work, design processes and flows of design knowledge. Design researchers who want to contribute useful knowledge can benefit from having a better understanding of when and how different kinds of knowledge can make a real difference to the design work.

> **'Emerging evidence from the literature, piloting and feedback, contextual factors and organizational shifts can identify a need or opportunities to adjust and realign the design and development of an educational innovation *at any stage* prior to implementation. It may be necessary to adjust strategies to optimize the intended outcomes.' (Udemans et al. 2018, p. 6, emphasis added.)**

This is a much more responsive – and potentially expensive – model for carrying out design and implementation than one finds in the classic literature on how instructional design should be done. Crucially, it places additional demands on the *timely* production of design knowledge.

Design research also needs to help analyse current educational and training activities and systems. We need clearer, more robust and more grounded ways of understanding how specific learning events actually unfold. The useful question is not 'what works?' but 'what works, for whom, in what circumstances?' In other words, we need to understand the how and why – the actual mechanisms – of successful and unsuccessful learning events (Wong et al. 2010, 2012; Ericson et al. 2017). Recent research in the cognitive and learning sciences makes it clear that such mechanisms are not purely mental – they involve subtle combinations of brain, mind, body and world – and that any usable explanation of a real-world learning event is likely to involve references to the physical (material, digital) and social resources that come to hand during learning activities (diSessa, Levin & Brown 2016; Goodyear & Dimitriadis 2013; Markauskaite & Goodyear 2017). Studying learning in and for professional practice then involves careful tracing of the roles and movements of people, ideas and material and digital objects – as they embody and extend what participants can be said to know (Fenwick & Nerland 2014; Jensen, Lahn & Nerland 2012).

This is a very different way of understanding the relationships between technologies and learning than we find in the loose correlational studies of mainstream educational research and summative evaluation. While correlations can sometimes be useful in discovering interesting associations between inputs and outputs, they tell us little or nothing about the important mediating mechanisms – what is actually happening within the 'black box' of current learning activities. This is also a different way of conceiving of relations between design and research than one finds in the burgeoning educational literature on Design-Based Research (DBR). For one thing, DBR rarely has much to say about the processes of design itself: DBR implicitly assumes that it will be possible to convert evaluation outcomes into actionable knowledge for redesign on every iteration in an intervention's lifecycle (Zheng 2015; O'Neill 2016).

Design research needs to be informed by, and tell us more about, how design is done. It needs to help us analyse and explain how current learning systems actually function. It can also help us see what should and can be changed in order to improve valued outcomes. This proposition has some significant corollaries.

First, we need to distinguish carefully between what can be designed ahead of time and what must emerge 'at learntime'. What learners do, during a training event, is not designable. However, design can play a key role in shaping the circumstances in which learning activity unfolds. Learning cannot be designed, but it can be *designed for* (Wenger 1998). Second, the art of distinguishing between what can easily be changed and what can't acquires an important place in the repertoire of design know-how. If we are serious about design, then we need to acknowledge the power of design thinking to *reframe* a problem – helping reveal the causes behind symptoms and the structural forces that constrain and enable certain kinds of action. To restrict design to tinkering within taken-for-granted limits is to waste some of its power. Conversely, designers need to develop a 'feel' for the edges of the spaces within which they can act: not accepting *diktats* from above, but not wasting scarce time and resources trying to shift immoveable objects. Third, designers need to be comfortable working on definitions of value – collaborating with other experts in formulating robust descriptions of valued working practices and capabilities and the links between them. This does not exhaust the matter, but these questions of what is designable, what is changeable and what is valuable capture the main considerations.

SHARING DESIGN KNOWLEDGE

The second major issue in thinking about actionable knowledge for design is concerned with communication and action. Are some methods and formats better than others for encoding, sharing and interpreting design experience and the outputs of design research? For example, *design principles* are relatively easy to formulate but notoriously difficult to apply (to specific cases). *Design patterns* have the potential to combine specific guidance with a rationale for their application, but their take-up in educational design is very patchy (Goodyear & Retalis 2010). Attempts to invent and impose formal systems for design practice have not enjoyed much success, unless mandated by very powerful customers.

One possible way forward is to acknowledge the different kinds of actors involved in co-configuring any real-world learning situation and to map the knowledge flows in which they can usefully be involved. This helps to crystallise an otherwise very complex, fluid and uncertain situation. For example, to the extent that learners pro-actively (re)configure the learning tasks set for them, or the learning environments in which they work, we can ask whether it is possible to enhance what they do, through prior education or just-in-time guidance. We can see educational designs as part-finished artefacts which need to be understood, customised and handed on by their various users, over their whole lifecycle (Krippendorff 2006).

This does not require a serious rethinking of what design for learning encompasses, or of how it should be done. Rather, it implies taking a more *expansive* view of what a design consists of – how explaining more of the rationale for a design may be useful to both learners and other designers.

This touches on a key point about the relationship between research on learning and design for learning. Many people find themselves taking on a professional responsibility for other people's learning without having any proper training for this part of their role. They may be in an academic or workforce management position – as a dean or unit leader – or they may be moving sideways into educational technology, training or educational design. It is understandable when people in such positions complain about the poor state of educational research and the lack of consistent findings about how people learn (Albert et al. 2007; Dolmans & Tigelaar 2012). It would be lovely if every educational design decision we have to make could be informed by an evidence-based, theoretically coherent, conceptually clear principle, whose scope exactly matches the problem on which we are working. But this desire is rooted in delusion. Learning is messy. There are very few principles that have wide application. One of the best-developed areas is cognitive load theory, which stresses the limited capacities of working memory (Sweller 2004). Everyone has a limited working memory – human beings can pay attention to only a small number of things at one time; those things that are escaping attention are not going to find a place in long-term memory; they will not be learned. So educational design ought to avoid creating excessive cognitive load on learners. Sadly, there are very few other areas of research on learning that have this potential for breadth of applicability. Moreover, the meaning of 'things' in the phrase above – 'only a small number of things at one time' – varies from person to person, because it depends on the familiarity of the 'things'. To cut a long story short, familiarity allows us to mentally 'chunk' collections of associated 'things' into more complex 'things' and each of these compound things takes up only one slot in working memory. So, at a minimum, design principles need to take into account both the limited capacity of every working memory *and* variations in the familiarity of the material being taught. The limited working memory principle has a very broad application – it applies to all human beings – but the need to design in ways that take account of variations in familiarity with the material takes us into more complex territory. We have to find principles that apply to the current context.

This example is important because it helps to make a crucial point about actionable knowledge for design. Only a tiny fraction of the knowledge that we can use in design takes the form of universally applicable principles. Much of the knowledge that can be drawn upon in design is heavily contextualized: 'x is likely to be true if a, b and c are true here'. Understanding the relations between each piece of knowledge and the circumstances in which it is dependable is – or should be – a vital part of each designer's professional knowledge base. It is an important aspect of *epistemic fluency* – the ability to recognise and work with a variety of kinds of knowledge and ways of knowing (Markauskaite & Goodyear 2017). With experience, designers develop a *feel* for the landscape of knowledge that can guide their work. They know when a broad-ranging principle may be useful. They also know when decisions will have to be made on the basis of very specific, locally-true circumstances. Christian Voigt talks about this in his exploration of the strengths of design patterns and pattern languages: their nested, conditional forms map nicely onto heavily context-dependent design ideas (Voigt 2010).

CONCLUDING COMMENTS: NEXT STEPS

Sharing educational design knowledge is a chicken-and-egg problem. As a practice, it is still too rare for us to be able to infer useful formats for encoding and sharing design knowledge. Yet the absence of tools and other artefacts embodying design knowledge impedes the growth of sharing practices. In my view, this is an area in which ambitious journals can play a useful role: stimulating innovation in methods and practices for sharing knowledge that is useful for educational designers (Laurillard 2012) and providing incentives for what should be an important aspect of professional work among education and training practitioners.

At a less formal level, there are also some encouraging signs in the take-up of novel collaborative design practices. For example, Young and Perović (2016) and Carvalho and Yeoman (2017) describe simple card-based methods for collaborative educational design work which turn out to be very good at promoting animated discussion of design ideas and assumptions: useful instances of collaborative reflective practice. Authentic, situated design discussions of this kind have considerable potential as sites for surfacing and sharing experiential design knowledge within education and training organisations (Simonsen et al. 2014).

Organisations that are serious about strengthening their design capabilities can make a big difference to our whole field, providing opportunities for those who are involved in educational work to reflect on how they apply what they know, what they learn while tackling new projects, and how this learning can be crystallised and shared. For example, a great deal of serious learning goes on within any major design project. New understandings are developed of specific connections between patient outcomes, working practices, practitioner capabilities, training events, educational resources, design ideas and design methods. Design teams learn a lot about the real nature of these connections in specific circumstances. Unfortunately, much of that learning remains implicit and little of it is shared with the wider world. It tends to be treated as anecdotal, partial, and not as reliable as the knowledge that is acquired through large-scale systematic inquiry. One of the challenges for the health education and training field is to become more sophisticated about diverse forms, kinds and sources of actionable knowledge: to foster, within our design practices and workforce, a greater epistemic fluency.

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