Chapter 1

DESIGNING FOR THE SOCIAL DIMENSIONS OF LEARNING IN CME

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ABSTRACT

While the all-important social aspects of learning may occur spontaneously in informal, ad hoc interactions between medical professionals, design for learning can increase the frequency and impact of peer interactions in formal and informal settings. In this chapter, we set out to describe how design can facilitate social learning in continuing medical education. Design for learning is not deterministic, but rather can enhance the efficiency and effectiveness of all dimensions of learning, including the social dimension of learning. Design can be considered at three levels: meso, micro and macro. Each level of design should be informed by available evidence about how professionals learn, by a deep understanding of the professional episteme, and by thoughtful observation of naturalistic socio-professional culture and behaviours. Improvements in design for learning that attend to the social dimensions and network effects of learning should result in improvements not only to individual practice performance but also in the capacity of the whole health care system to respond to new challenges. This calls for an extension of the conceptualising of learning design at the macro-level.

INTRODUCTION

Our experience in the design and delivery of continuing medical education (CME) has taken place during the most dynamic and innovative twenty years in the history of professional education.

Twenty years ago, Knowles (1980) had only recently first proffered the principles of andragogy; productivity conscious employers were beginning to get seriously interested in training and education; computers were just starting their first tentative moves in their takeover bid for every aspect of our work and leisure, aided by their emerging co-conspirators

the world wide web technologies; educationists were beginning to argue seriously about learning theory and nothing much had changed in medical education since Hippocrates.

In the past two decades, there have been major advances in two areas of particular importance to continuing medical education (CME). Most obviously, advances in information technology and telecommunications (ICT) have produced tools which provide educational affordances which were unimaginable twenty years ago. In the same timeframe, there have been major advances in our understanding of how professionals learn (Webster-Wright, 2009) and the way this may influence the quality of care and patient outcomes. The convergence of advances in these two domains has resulted in a completely new discipline: Learning Design. Design is the key to the successful integration of learning theory and ICT tools for CME. A particular challenge for learning design is how to facilitate the complex and little understood social dimensions of learning. Although the social web has exploded into almost every aspect of the human experience, the question arises as to how this network technology can be exploited effectively by professionals in pursuit of educational goals and practice outcomes.

Since 1995, our team has designed, developed and delivered several hundred online and blended programs engaging more than 50,000 clinicians, mostly doctors. In so doing, we have been unapologetic pragmatists in an uncertain world - designing using whatever theories, evidence, epistemic insights and practical experience were available to us at the time; harnessing technological affordances where they could be found; watching the data from this living laboratory with obsessional intensity; trying to improve good designs when we found them and to fix poor designs when we had to; and, eventually, coming to understand how to describe how we do this in a new lexicon. Coming from a lived experience of reflective practice, we were excited by the emergence of design-based research with its acceptance of messy real-world situations, and inspired by the elegance with which pattern languages walk the fine line between rules and creativity (McAndrew et al., 2006; Bianco et al., 2011). It seemed to us that these cyclical processes complement and build on each other while drawing on and feeding back into the corpus of received theory. So when trying to decide in which paradigm we felt most at home, we decided to adopt and integrate them all.

THE IMPORTANCE OF THE SOCIAL DIMENSIONS OF LEARNING FOR MEDICAL PRACTITIONERS

Until the last decade of the twentieth century, despite the fact that we innately knew that professionals must and do continue to learn, almost nothing was known about how they learn. Studies of CME tended to be case commentaries. In the 1990s, a meta-analysis of the available research on the efficacy of CME interventions (Davis, 1998) used the Cochrane Collaboration methodology (Mulrow et al., 1996). For the purposes of the analysis, formal educational interventions were conceptualised as similar to treatment interventions. The analysis established that for most of the prevailing modes of CME, there was no convincing evidence of an effect on practice behaviour. Some evidence for effective practice change was available for modes which included some social dimensions of learning and were related to real practice challenges.

Ann Webster-Wright, a clinician and educator herself, reviewed the literature on professional learning (Webster-Wright, 2009). She has provided us with an eloquent and practical summary of how professionals continue to learn in practice. In summary, effective and sustainable learning, that actually changes practices, involves the active engagement of professionals, working together, to inquire into and question real problems that matter to them and their clients. Learning is action orientated yet grounded in a reflective stance. Lest we should think that this is just a call for more collaborative modalities in formal courses, Webster-Wright points out that much of the most effective professional learning occurs outside of the formal setting (Webster-Wright, 2010). The implication for course designers is the need to conceive of their interventions as a "slow-release drug" with the potential for cumulative effects over long periods of time.

There is now strong evidence for the importance of the social dimensions of learning between the early literature reviewed by Davis and the later review done by Webster-Wright. There is something particular about medical and other professionals as learners. As professionals we are peer referencing and peer normative. Individuals identify as members of the profession and the profession creates, holds and evolves the body of knowledge and culture, including ethical values, particular to their profession (Beatson, 2010). While knowledge and skills might arguably be developed by self-directed study and reflective practice, values, attitudes and cultural norms may need to be challenged to change practice. This type of professional development involves a social negotiation best done with and by peers.
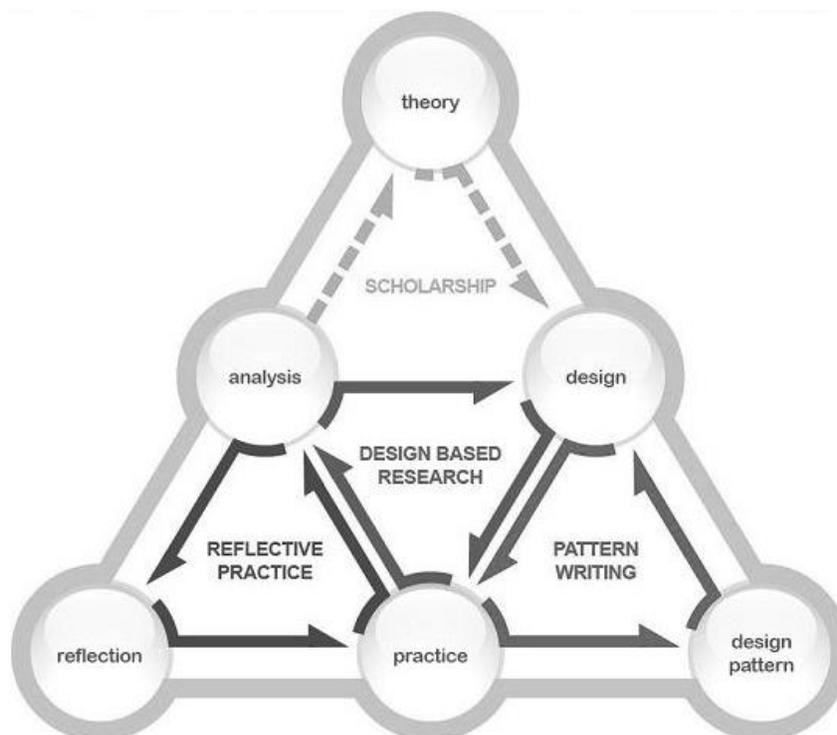

Figure 1. Metcher's triangle: The relationship between methodologies which support improvement.

THE CASE FOR DESIGN

It would be easy to assume that social learning is the native mode for professionals and therefore that design has no role, except possibly to design some network "spaces" in which doctors can find each other. Or even that it is in the nature of design to be deterministic, and as such, it might get in the way of productive naturalistic social behaviours. We do not subscribe to either view, but rather that design should enhance and add value to the natural social interactions which underpin the social dimensions of learning.

The term "design" is itself attached to multiple meanings. Because learning cannot be designed, we, like others, contend that learning design should be cast as design for learning: one of many members of the design disciplines.

Our definition of design is broadly conceptualised and draws on a number of design disciplines including industrial design. It characterises design as an intentional, creative activity to conceptualise and establish the qualities of objects, processes, interactions and services which enable the achievement of a purpose over a defined life cycle. It is specific enough to provide discipline, but not so narrowly framed as to foster reductionism. It recognises that design cannot focus on a subset of components, but should take into account all components, human and material, and the interplay between them. This design definition is, however, broader than many conceptualisations of instructional design and learning design. It is broader because it encompasses more components and more complexity in the relationship between the components. It is also longer because the life-cycle notion accommodates a more longitudinal view of learning design intent than the structured classroom activities.

Goodyear adopts a similar view, by inference, when he makes three assertions about design for learning:

- design for learning is chiefly concerned with design of good learning tasks
- design for learning must also attend to the social and physical setting
- design for learning needs to work fluently across scale levels: linking macro, meso and micro (Goodyear and Carvalho, 2013)

With regard to the design of tasks, Goodyear makes the point that tasks as designed objects are nested in both a task architecture (a task hierarchy) and an "epistemic architecture a structure of knowledge and ways of knowing which are peculiar to a discipline, profession or practice" (Goodyear and Carvalho, 2013). Unlike learning design for primary through tertiary students, design for learning in the continuing professional development context can draw on a well understood episteme and a rich existing social capital. We have found both factors to be vital considerations in design for CME.

Goodyear explains his use of the meso-, micro- and macro-levels:

- the *meso-level* (and the traditional terrain of learning designers), concerned with learning activities which run over hours or days
- the *micro-level*, the moment to moment experience which holds the attention and task focus of the learner

- the *macro-level*, which conventionally addresses the larger issues of design which affect education such as budget, policies and buildings (Goodyear and Carvalho, 2013)

We extend the macro-design beyond Goodyear's ideas in three ways. Firstly, we consider the role of learning design in influencing the ongoing systemisation of practice change over time. These downstream effects, accumulated over many interventions, are not only possible and likely but can be designed for. For example, new skills in diabetes management may need to play out over several cycles of quarterly patient HBA1C reviews before the full range of application occurs.

Secondly, we consider the social dimension of learning to extend out beyond the immediate learning cohort to the wider peer group, and ultimately to the whole profession. These extended peer groups all have a potential influence in the professional learning setting.

Thirdly, given the central role of professions in the governance of many key sectors, the professional learning setting is not in fact far removed from the "budgets, policies and buildings" arena. The policy level, while it might manifest in a variety of ways, is also within the purview of the CME "classroom" due to the power dominance of the medical profession in the health system. (Davies, 2000)

MESO-LEVEL DESIGN

The meso-level deals with educational experiences as they are normally packaged as interventions – typically a course or module. The engagement pattern of doctors, like that of other busy professionals, is typically a couple of hours (a module) to a maximum of 1-2 days (a course). Design at this level will start from the definition of specific learning needs translated into learning goals.

Almost twenty years ago, when we first offered CME online, research evidence about CME in general was scarce and difficult to critically appraise. We were driven by a passion for improving outcomes for patients through the most practice changing CME we could conceive. We had to be very good at engaging doctors; the competition, largely from the pharmaceutical sector, was providing free offerings, with great food and wine thrown in. This had the fortunate effect of sharpening the design mind.

Our design principles could be summarised as follows:

- learning should involve a variety of learning activities, avoiding defaulting to passive, didactic modes
- it should be collaborative, engaging learners not just with experts but with peers
- it should be situated in the context of practice

As discussed earlier, these design principles are well evidenced in the research literature. (Bird, 2007; Mazmanian and Davies, 2002) These are guiding principles for CME learning designers regardless of which technology is supporting the experience. They apply whether the setting is a local doctors' study group, a meeting hosted by an education provider, or an online learning community.

While "groupness" is a normal state for humans, it cannot be assumed that interactions within groups will be positive and productive in their naturalistic state. We soon learned this from bitter experience while working with online groups in the mid-nineties, when the available toolkit was extremely rudimentary. We had spectacularly poor success measured by group functionality in online medical groups that we hosted. Of the first sixty-four groups we hosted, some of which were learning communities and some had other professional objectives, only four developed the level of functioning sufficient to sustain them as a group and produce outcomes related to the group's objectives. Eight others had some signs of early promise, but failed to achieve objectives and engagement soon fell away to nothing. All of the following factors were in evidence and explicit in all the successful groups:

- a visible, active leader or leaders
- a means of knowing who is included in the group
- an explicit mission, aim or objective shared by the group
- a shared view of the "rules" of engaging to achieve the objectives
- appropriate (shared) resources
- common spaces in which to conduct the business of the group
- an understanding of the timing of the activities
- some social capital (shared language, culture or experiences) on which to build

Further, the partially successful groups were also distinguished from the failed groups in that they each evidenced most (but not all) of these factors, although the factors that were missing varied (Robinson et al., 2011).

Using a design based research approach, we have continued ever since to build these factors into all aspects of our designs for the social dimensions of learning for doctors. This design pattern is called the *Essential Eight* in our design pattern language. Over time, we have further unpacked the factors as they apply and become more specific for various sub-groups and circumstances. We now have over thirty related design questions to ask and answer as we begin to design for any learning network. But the breakthrough moment was the codification of the first eight top level design factors. Though it seems astonishing from this perspective in history, the first software toolkit embodying these eight factors, with its ugly, green mid-90's graphic user interface, was good enough to support effective group functioning for all the groups who experienced it. And the most successful of all was the ugly green thing called *Grand Rounds*. More on that in a moment.

Arguably, we could only have observed key design success factors for medical groups because we were working with fully online groups. Face to face groups with a common purpose tend to quickly bring into play the features and factors they require to be functional, regardless of how the session is designed. This is one type of example of what Goodyear calls "co-design" (Goodyear and Carvalho, 2013). In any case, the ability of face to face groups to quickly put in place the basic ingredients for minimal functioning provides a mechanism that compensates for inadequate design. Online groups, hampered as they are by the absence of the familiar social whole body experience, cannot so easily overcome social design gaps (Robinson et al., 2011). Design for online groups is design without a metaphorical safety net.

So the first model for social design which underpins all our CME is that online learning groups should have the benefit of explicit social design. Goodyear also touches on the need

for learning design to attend to more than just the organisation of resources and learning tasks (Goodyear and Carvalho, 2013).

Our online learning networks, whether they involve a short module, an extended course experience or a broader learning community, have an explicit social design. This design is not intended to constrain the natural propensity of groups to adapt and enhance their social and professional connections, but rather to provide a familiar and efficient starting point. In a short module, there is little time for learners to waste negotiating and establishing their own roles and rules of engagement. In a longer lasting learning community, co-design can become a big part of how the group works, with groups spawning their own problems to work on and their own ways of organising themselves.

A brief example of the application of the Essential Eight in a short module, say for improving chronic disease management approaches for diabetes, for general practitioners (family physicians) is outlined below.

A Visible, Active Leader or Leaders

The facilitator has a strong personal presence by means of at least a photo and a guiding message on each important screen. The message is personalised, using the name of the learner, and customised based on the state of the learner - for example, whether they are just about to commence the activity, or are returning to review something, or have indicated that they want to contribute. The facilitator (leader) would be an experienced general practitioner rather than a subject matter expert (an endocrinologist), because further observation of and consultation with general practitioners indicates that learning groups prefer an experienced peer facilitator. This does not preclude the valuable contribution of subject matter experts, but the role for these people is a technical resource to the group rather than the learning group leader.

A Means of Knowing Who Is Included in the Group

The target audience is clearly nominated, in this case general practitioners implying that the invitation to join is open to people who identify as GPs. Often a list of participants' names and contact details is published on enrolment. Even when this is not the case, the module will commence with a welcome discussion in which the facilitator invites all participants to open with a brief introduction about themselves – name, brief professional profile, practice setting and motivation for joining the group.

An Explicit Mission, Aim or Objective Shared by the Group

Learning goals are featured prominently in the program and its promotional material, and this is reinforced in the welcome discussion.

A Shared View of the "Rules" of Engaging to Achieve the Objectives

The facilitator provides a brief outline of the module and the activities. The activities are designed to reflect the episteme and the professional practice and culture, that is the standard engagement points and methods of peer to peer engagement familiar to general practitioners. We will address these further later.

We pause here for a brief aside: in a group where these first three elements are in place, it's vanishingly rare to see any inappropriate or even misplaced behaviour. We know it's not just the password protection that produces this effect. We rarely see even attempted inappropriate access, and there's a total absence of members using the forums for other than professionally acceptable behaviours.

Appropriate (Shared) Resources

Summaries of best clinical evidence and practice and case material form the core of the module. But a variety of other resources may be included (see Table 1).

Common Spaces in Which to Conduct the Business of the Group

The arrangement of the online spaces in a short module basically follows the learning activity flow. Rather than jumping in an out of discussion tools/spaces, we include multiple discussion "pockets" at the point where a discussion is called for by the facilitator.

An Understanding of the Timing of the Activities

All modules and the sub-activities within them have time estimates prominently displayed. Progress tracking enables participants to know how far into an experience they are at any point. None of the activities require synchronous discussion, which is a practical impossibility for most working doctors.

Social Capital (Shared Language, Culture or Experiences) on Which to Build

We use a rich repository of hypothetical doctors and patients as the basis of most of the case discussions. These characters have been co-developed with the aid of the general practice community. They include a set of about a dozen archetypal doctors. Often the medical archetypes feel so familiar and "real" that participants are convinced they are based on particular colleagues they know well. Hypothetical patients are crafted to make realistic teaching cases and include sufficient detail to create realistic doctor-patient dynamics necessary to stimulate discussion about holistic approaches to care.

The cases are plotted on a matrix to reflect the variety of practice contexts in the Australian setting – from extremely remote practice to inner city; from wealth privileged

suburbs to disadvantaged, refugee or indigenous communities; from well serviced areas with other specialist health services and support services to isolated underserved communities where the local family doctor must provide most of his/her patients' needs.

As well as didactic, evidenced based resources, the module designers would employ a combination of the strategies and activities described in the table below.

These strategies are commonly employed by educational designers and would be familiar to anyone working in the field of continuing professional education. By further analysing both the epistemology and the socio-professional culture of a particular profession, in this instance, doctors, learning designers can finesse these strategies in ways which lighten the load of both the learning designer and the learner.

To illustrate, let us look for a moment at the term collaborative which covers a multitude of meanings as it relates to continuing medical education.

Many doctors do not in fact typically collaborate in the conduct of their core practice – patient care. By contrast, engineers or architects typically work in teams when they exercise their professional skills. In the moment to moment of the clinical process, a doctor is alone with his or her patient and the problem. If we use this insight in designing collaborative learning, we would expect to design different collaborative activities for doctors than we design for engineers. Engineers might have hypothetical project problems which learners would engage to "solve" together. Should we design cases for doctors to "solve together"? We think not. A nuanced understanding of collaboration is required and is possible by considering the work practices and culture of the profession.

Doctors are members of a profession. The profession holds on behalf of the community a complex body of knowledge from which individuals apply skills and judgement to effect good outcomes with and for their patients. Doctors hold themselves to standards of practice which are collectively created and held by the profession - the collective of doctors (Beatson, 2010). Everything that leads up to the moment of judgement in the clinical process is preparation for the application of that complex body of knowledge in this particular situation. And afterwards, the process and the outcome might be subject to personal (or even collective) reflection with reference to the standards of the profession.

The typical collaboration for doctors is not to construct the solution together, but rather to peer review the critical moments of judgement in the clinical process. From this benchmarking of individual judgement and critical analysis, individuals can synthesise approaches for potential future application in similar situations. Moreover, the collaboration at these points may subtly influence the collective view of best practice standards, underpinning a moment to new professional norms.

Learning design can use this insight to craft collaborative learning opportunities more effectively. Figure 2 is a schematic representation of the clinical process and the points at which judgements must be crystallised.

These judgment points are the naturally occurring common points between the doing of practice and the reflecting of collegiate learning. They are the points which learning designers can use to create discourse around hypothetical case dilemmas and the points at which hypothetical archetypes might make typical decisions – good, bad and indifferent – which can stimulate critical analysis by the group.

Table 1. Module activities in relation to evidence based learning strategies

| Learning design strategy	Activity	Description
Active, social and related to practice.	Action learning worksheet +/- tool + report back.	Work through a process using a practice problem and share experience with others.
	Hypothetical case.	Work through a case, related to practice and apply skills, and knowledge.
	Practice activity +/- tool.	Apply skills & process to a work-related problem, reflect on performance and discuss with others.
Critical reflection – challenging current assumptions and practices.	Audit of practice.	Audit professional practice against best practice & group, report results, reflect, discuss & plan to change practice.
	Challenging attitudes and behaviours.	Reflect on attitudes and behaviours, identify them and challenge them with best practice.
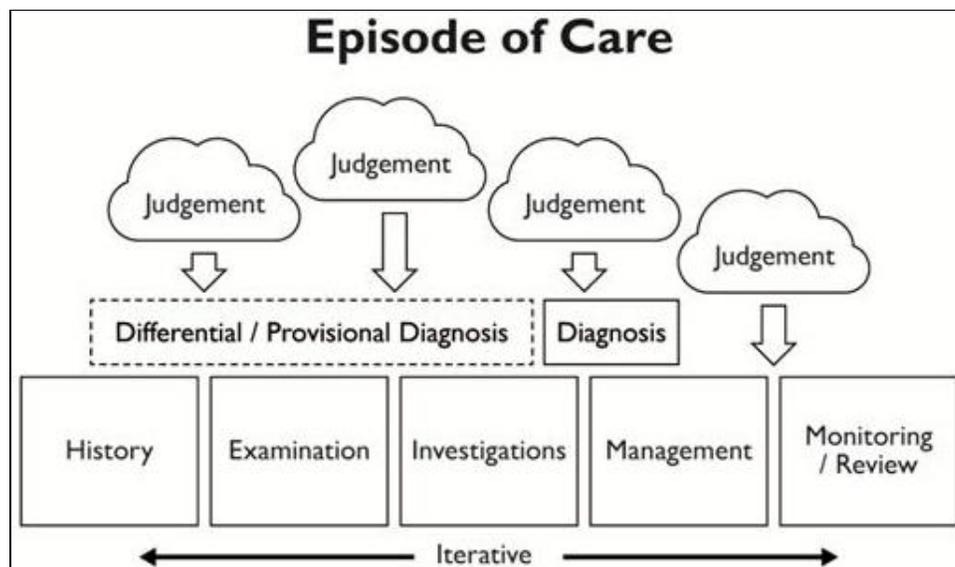
Figure 2. Schematic representation of the clinical process for an episode of care.

And this is a good point to move down a layer into the micro-design – the layer which addresses the moment to moment experience of engagement and interaction happening in social learning activities.

MICRO-LEVEL DESIGN

Both learning and social interactions are complex and messy (Webster-Wright, 2010). It is not surprising that we designers tend to avoid asserting a deterministic role for design in either of these human phenomena. When learning designers describe their role, we sense that it does not extend to designing the small interactive moments which we can observe

happening when professionals come together. Terms like "group discussion" and "group activity" are in common use. But at the level of what happens in the moments of these learning activities, we tend to leave it to the online learners themselves to make best use of the opportunity, perhaps first offering some guidance on how this might be done. Sometimes we throw the responsibility onto the online facilitator.

However, we assert that micro-design can be much more "micro" than simply noting that a group discussion (for example) should take place at a certain point. The work of Dimitriadis et al. (2012) on classroom orchestration begins to show us how much further micro-design can be taken, but the challenge remains to adapt these insights to profession learning. We might turn to the literature on workplace collaboration, but we note that it tends to be largely concerned with developing models of best practice to which employees should conform. We believe that context and authenticity are critical to professional learning, so both of these very valuable starting points need to be completed by an anthropology of learning and collaboration within specific professional groups.

In the absence of useful research, and immersed as we were in the highly stylised medical culture, to inform our design attempts we relied on observations of social behaviours that are on display to any thoughtful observer at any medical education event or in learning communities (such as hospital units or group practices). It would be wonderful to have the time and funds to put some more rigour around these observations, but these informal yet conscious observational studies have served our micro-design thinking well so far.

For example, medical specialists do not typically ask questions of speakers from the floor at conferences, regardless of how enthusiastically the chairman encourages them and even models behaviour by asking the question the chairperson prepared earlier. Typically, they throng the expert immediately afterwards. Is this an unwillingness to display doubt or potential sub-competence in front of peers? Given the "trial by fire" which the trainees in medical and surgical disciplines have been subjected to it is not surprising that they are reluctant, perhaps even unconsciously, to put themselves forward in such public circumstances. In contrast, groups of general practitioners seem much more comfortable with exposing themselves in front of peers. Our favourite recorded examples of this include typical Australian self-deprecating phrases such as "one of my usual stuff-ups" or "whoops, that's the sort of thing I would do". We could speculate that the kinder, community based training program for family medicine leaves its graduates less damaged, or, perhaps, in a generalist field, the impossibility of perfection across the whole of primary care is a daily reality which practitioners come to live with and, hence, have no shame in acknowledging.

But how are these observations useful to designers of social learning? We offer here one of potentially many design solutions. Logically, having observed the dynamics discussed above, the design for surgeons should provide plenty of opportunities for interaction with the technical content and anonymous benchmarking before opening up a general discussion. This might include optional quizzes where your marks can be privately compared to the pool (in our experience, surgeons seem to like a competition if there is no risk of anyone else finding out your score if it's not great). The premise is that a discussion amongst surgeons may only be free flowing if the participants are confident that they are going to be well enough equipped. An alternative might be to provide for anonymity of contributions, which although prime facie seems unpalatable, may be preferable to no peer to peer interaction at all.

The design for general practitioners might be quite different. Recall our experience that a good facilitator for a general practice group represents the learning group rather than the

expert. In an online group of general practitioners, all that seems to be needed is for the facilitator to go first and admit to doubt or weakness along with any other appropriate contribution.

But other observed cultural social norms are also useful. By observing that doctors are acculturated not to publically criticise each other, we infer that good design demands the use of hypothetical doctors making understandably flawed judgements. This can be a better stimulus for frank and forthright group critical appraisal than a case presentation of a real case by the attending doctor, allowing as it does for medical professionals to endorse or condemn professional judgement with intellectual rigour but with social impunity.

Observation of social norms in learning situations can also stimulate us as designers to seek to improve on naturalistic or traditional social learning activities.

Recall the "grand rounds" reference from our earlier discussion on group design. Grand rounds is an old fashioned term, now fallen into disuse in Australia, which describes the habit of large teaching institutions to convene a meeting of all doctors in the institution, or at least that discipline in the institution to review cases and learn from them. At grand rounds, a particular case would be presented by the treating team, usually by the advanced trainee (called the "registrar" in Australia) rather than the senior treating doctor. Sometimes the unfortunate patient was put on display in front of the assembled crowd to demonstrate the physical signs of disease. Always the case was presented in the ancient sequence described in Figure 3 earlier. Sometimes the questions/discussion were held to the end of the case presentation, but more often the presentation was broken into at the points corresponding to points of judgement (see also Figure 3). In "the bad old days", the forthright public criticism of the judgment of the registrar by his or seniors was deemed to be educational but, even then, was probably the only venue in which public criticism of a colleague (albeit a junior one) was acceptable.
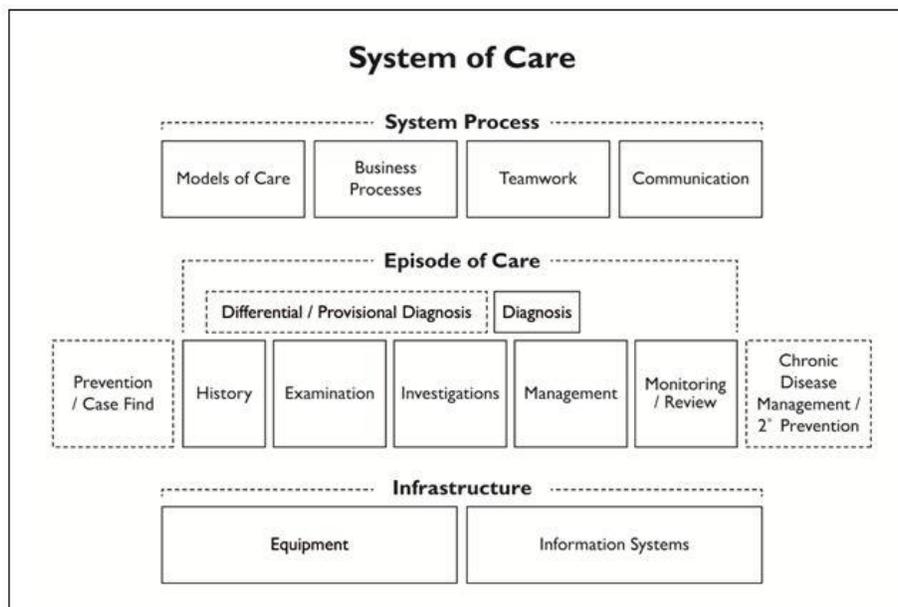

Figure 3. Schematic representation of health service system.

Now, grand rounds are called case presentations. A case presentation these days is generally a somewhat kinder and more reflective exercise, grounded more in notions of the social dimensions of learning than the dubious value of public humiliation as "tough love".

But, what can a learning designer take away from the phenomenology of this group learning activity, which might inform improved design approaches to networked social learning? The first observation is that in the natural state, there are very few active participants. Certainly, the case presenter has had the opportunity for rigorous professional reflection honed by the prospect of an audience of peers. But what of the rest of the group? A small proportion of the rest of the group might engage overtly with the points of judgement highlighted in the case. We are left to hope that the silent majority are mentally placing themselves in the role of the attending doctor and reflecting on what they would be doing, but they could just as easily be mentally composing a shopping list.

There is a clear challenge here for learning design – how can we get the passive majority to "get more skin in the game!" as a colleague of ours eloquently puts in. One answer is to use polling tools, which provide wonderful affordances for the social dimensions of learning. By design, we can have everyone take a judgement position at each of the key points of the clinical processes. In a face to face session, we can use one of the "clicker" systems. Online it's even easier – we interpose a survey tool as a mandatory step before we move into the discussion. Now, as well as converting potentially passive, disengaged participants into actively engaged participants, we also have a whole of peer group data set from which to launch a discussion. The discussion now has potential purpose and form, comparing, contrasting, justifying and contextualising the critical judgements of the whole professional cohort.

A MINI-AUDIT EXAMPLE WITH MICRO-DESIGN

In Australia, according to the Royal Australian College of General Practitioners, one standard for child health services provided by family doctors is the pre-school eye check. Clearly, some necessary equipment is required, including a special eye chart for testing visual acuity in pre-literate children. We included a short survey in which doctors could tick off which pieces of equipment they had access to in their rooms. Surprisingly, amongst other deficiencies, it revealed that less than half the participants had a paediatric eye chart. This clearly shocked the cohort, and a robust discussion ensued. Not coincidentally, we had placed a discussion tool at that point in the learning sequence. The discussion included some of the typically self-deprecating humour of Australian general practitioners which demonstrated a clear acknowledgement of deficiencies of both infrastructure and by implication service provision. Even more interestingly though, the set-up question challenged the discussants to fix the problem. Information on how to source the appropriate equipment (including for free from willing pharmaceutical companies) was shared by those who knew. To our great surprise, this lead on to yet more fruitful discussions on other more ambitious service infrastructure such as slit lamps. There evolved a very sophisticated group problem solving discussion on how to access both this expensive piece of equipment and the attendant skill set, or gain access to a local service provider as an alternative.

Considered design of polls and stimulus questions for case discussion informed by thoughtful observation of natural social learning behaviours is only one example of how design plays a role in networked learning. Another example which we discovered almost serendipitously is now named mini-audit. Mini-audit is a design pattern which involves a short survey to mentally or physically send learners back into their workplace setting to quickly and informally audit some aspect of their current practice. One of the first mini-audits we designed was incorporated into a module for general practitioners on paediatric ophthalmology. The module was undertaken by hundreds of general practitioners and was completely online. It was a clear demonstration of how good design can stimulate even better co-design when participants join in.

This augmented discussion is an example of co-design (Robinson et al., 2014). The participants, having appreciated and met the original goal, saw an opportunity to appropriate the set design and use it to achieve a purpose well beyond what the learning designers had in mind. This is also an example of how the different layers of design are dynamically in interplay. And this leads us to a discussion of the macro-design layer.

MACRO-LEVEL DESIGN

Macro-design, in accordance with our wider definition of macro-design, recognises that design can influence the way the profession redefines itself and what good practice looks like. In other words, design can intentionally stimulate the type of professional reflection illustrated by the general practice slit lamp networked discussion above.

The slit lamp discussion is an example of how, because a very large professional learning community was networked (originally around a very particular practice standard), it behaved in a way that we know professions do. It began to articulate a new view of the professional standards and processes in a related area of care, one that went to the very heart of the role of the family doctor relative to their ophthalmic specialist colleagues. To what would have been the horror of the leading figures of the ophthalmic community who (in Australia) are locked in a turf battle with their optometrist pseudo-competitors, the general practitioners collectively normalised relations with optometrists in their professional sub-culture. The pragmatism of general practitioners, particularly rural ones, is such that both groups who had slit lamps (specialist medical practitioners called ophthalmologists and the allied health professionals called optometrists) were appraised purely in relation to the usefulness to potential slit lamp solutions. The general practitioners quite happily made optometrists central to good solutions for access to slit lamps. This was a visible example of the network effects on professional culture – the general practitioners evolved and affirmed their own culture separate from that of their ophthalmic specialist colleagues. It is also a good example of the importance of meso-design in that, had the facilitator been a specialist expert – an ophthalmologist - instead of the general practice peer used in our design, the free flowing problem solving of the general practitioners would probably have been inhibited.

Learning design, if it encompasses this wider view, can play a role in health system reform and innovation. Macro-design opportunities are always present in networked learning communities but are particularly interesting when the learning is around the wider issues in

which clinicians operate. The challenges facing western health care systems demand attention to the whole system of care, not just the quality of acute episodes of care.

The integration of new technology such as computerised medical records and decision support systems is a complex system change requiring individuals to adopt and adapt to new ways of working. Even more challenging is the paradigm shift in health care from episodic care to the primary and secondary preventive strategies that are demanded by the shift in the burden of disease and an aging population. The rise of consumerism has paralleled a recognition that new models of care and new ways of working are called for to provide safe, affordable, patient-centre care into the future. For doctors, changes required to traditional practice call not only for new skills, but also for prerequisite reframing of attitudes and behaviours and even role conceptualisations. It is in the nature of professions that such change is the work of the whole profession.

The new network technologies can and do play a role in this innovation and reform agenda. Design for professional learning can and should address this community level learning and change. The new technologies have an expanded potential for large scale reach and for network effects, which both serve to enable this new macro-design thinking.

At this point, we as designers need to think in a complex system framework and not just attend to the needs of individual learners. This way of conceptualising learning design is not native to learning designers but we can find useful models from other disciplines.

Complex system theory recognises that complex systems are not able to be understood as the sum of their individual components, but as a complex network of relationships and interdependencies. The art (and perhaps it is not yet a science) of influencing complex systems is to identify the probable change levers which operate in different parts of the systems. Using judiciously selected levers, we hope to create what economists and engineers call virtuous cycles to facilitate system change and improvement.

For learning designers working on reform topics, this multiple lever approach might mean, for example, in one program or design:

- stimulating peer to peer pressure, perhaps on unhelpful professional memes or attitudes, with as many learners in the network as possible
- focussing on skill development for some already pre-disposed individuals
- and trying to enable those with leadership potential to find each other and co-design the appropriate forums or communication tools for the evolving community of practice

The key differentiator of this type of design is that it assumes that not all participants will have the same experience and that few, if any, individuals will undertake a logical linear learning sequence of the designer's devising.

Other useful frameworks to draw on for this type of macro-design from our own medical world are population health and health promotion. These frameworks recognise the need to have multiple strategies engaging with large communities in different ways at the same time. It would be nonsensical to a public health professional to spend all the effort and budget on a minute, self-selecting few in an attempt to, say, change eating habits. Yet, in medical workforce development and medical system reform, this is the prevailing approach to both design and evaluation of CME programs (Zimitat, 2001).
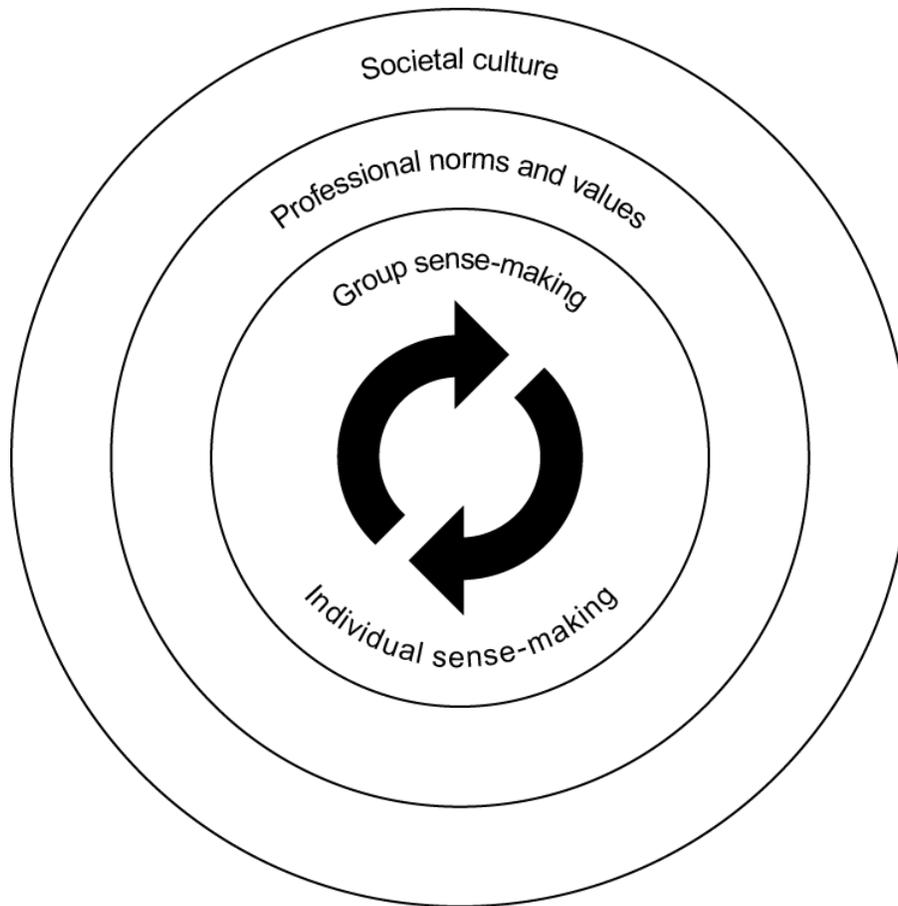
Figure 4. A conceptual framework for understanding professional culture.

We need to consider the importance of professional cultural change as a precondition for many aspirational goals for improved care and patient outcomes (Davies, 2009; Carroll and Quijada, 2004; Slavin et al., 2012). In this, we can also reflect on what we can learn from organisational cultural models for organisational improvement. Bloor and Dawson (Bloor and Dawson, 1994) described a model for organization culture in context which showed the link between the societal cultural context, the organisational operating system and culture, and the way in which individuals and groups undertake sense-making in relation to each other. Many doctors work in organisations, but all doctors work in a cultural construct which is their profession. Figure 4 is our conceptual framework for professional culture and sense-making which might be usefully applied to medical professional development and considered in macro-learning design.

Learning design can and should attempt to attend to the accessible levers which networked professional learning communities present to catalyse the sort of cultural shifts which are needed to underpin health care reform. By collegially addressing real problems in new ways, it is possible to shift underlying assumptions and "tilt the culture" (Carroll and Quijada, 2004).

This new approach to macro-design needs a corresponding new approach to evaluation. In large scale networked professional learning programs, the social dimensions of learning are in play both for any individual and also for the whole community. As well as the conventional educational evaluation approaches which address a hierarchy from engagement, through experience, impact and outcomes through the lens of individual learners, we need a new lens. We need a lens which accommodates the complexity of shifting professional culture and capacity – one through which we can identify trends and phenomenon that are in some way in operation in networked professional communities and which are associated with the tilting towards change-receptive professional culture.

While we do not have a solution to this challenge yet, some things are clear. For example, conventional educational evaluation counts as zero the learning of participants in programs who "fail to complete". Using any of the complex system models above to inform design and evaluation, this has to be a nonsense. If a program exposes several thousand doctors to new cultural norms negotiated with their peers, then that has to have an effect on patient care over time regardless of whether we can quantify the effect in the short term. The fact that only perhaps ten per cent of the thousands achieve the complete skill set deriving from the new norm is significant – it would be better if it were more. But complex theory tells us that this small number would face a hostile environment for executing these skills without the critical mass of cultural change that the thousands of as yet sub-skilled colleagues now represent. And these people are connected to each other through the designed network and through their own established informal and local networks.

CONCLUSION

For twenty years we have been reflecting on the available evidence, thoughtfully observing the episteme and medical culture, and applying design based research methodology over many program instances. What this journey has taught us is that design, if it is informed by all the above, is the key to catalysing and enhancing the naturally occurring social learning of the medical profession.

Because our learners, by virtue of the medical dominance in the health care system, are fully integrated by cultural and power connections in the complex system which is health care, we can and should extend our design scope to encompass this challenge. The new network technologies create affordances for macro-design which we are only starting to appreciate. But with new possibilities we need to challenge prevailing models and look outside traditional learning design, focussed as it has traditionally been on optimising the individual learner's experience.

Productive learning networks, particularly as communities of practice over extended periods, hold the possibility of enabling the type of professional learning which can challenge, reframe and reform the system itself. As design for learning is not deterministic, but rather adds value and efficiency to the complex and messy process which is learning, so macro-design does not seek to be social engineering, but rather to better enable the virtuous cycles which might naturally occur in the evolution of the medical profession and the complex system it dominates. For continuing medical education, in the form of designed experiences, all levels of design for learning are important and can work together, especially

in the creation of large scale productive networked learning communities. Such networks are likely to play a key role in system reform as health care systems all over the world come under increasing duress and the medical profession is called upon to play its part in the reform agenda.

REFERENCES

Beatson, G. (2010). *Why professionalism is still relevant*. Professions Australia Policy Paper. http://www.professions.com.au/Professionalism.html.

Bianco, N., Robinson, L., Metcher, J. & Hendy, R. (2011). Realising the Potential of Design Patterns in Professional Learning. *Design Principles and Practices: An International Journal*, *5*(4), 475-486.

Bird, L. (2007). The 3 'C' design model for networked collaborative elearning: a tool for novice designers. *Innovations in Education and Teaching International*, *44*(2), 153-67.

Bloor, G. & Dawson, P. (1994). Understanding professional culture in Organisational Context. *Organization Studies 1994*, *15*, 275-295.

Carroll, S. J. & Quijada, M. A. (2004). Redirecting traditional professional value to support safety: change organisational culture in health care. *Quality and Safety in Health Care*, *13*, Suppl II, ii6-ii21.

Davis, D. (1998). Does CME work? An analysis of the effect of educational activities on physician performance or health care outcomes. *International Journal of Psychiatry in Medicine*, *28*(1), 21-39.

Davies, H. T. O., Nutley, S. M. & Mannion, R. (2000). Organisational culture and quality of health care. *Quality in Health Care*, *9*(2), 111-9.

Dimitriadis, Y. (2012). Supporting Teachers in Orchestrating. In A. Jimoyiannis (Ed.) *Research on e-Learning and ICT in Education* (71-81). New York: Springer.

Goodyear, P. & Carvalho, L. (2013). The Analysis of Complex Learning Environments. In H. Beetham & Sharpe, R. (Eds.) *Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning* (49-63). New York: Routledge.

Knowles, M. (1980). *The modern practice of adult education: From pedagogy to andragogy*. Wilton, Connecticut: Association Press.

Mazmanian, P. E. & Davis, D. A. (2002). Continuing medical education and the physician as a learner: Guide to the evidence. *JAMA*, *288*(9), 1057-60.

McAndrew, P., Goodyear, P. & Dalziel, J. (2006). Patterns, designs and activities: unifying descriptions of learning structures. *International Journal of Learning Technology*, *2*(2-3), 216-242.

Mulrow, C. D. & Oxman, A. (1996). *The Cochrane Collaboration Handbook: Version 3.0*. San Antonio: Cochrane Collaboration.

Robinson, L., Bianco, N., Hendy, R. & Metcher, J. (2011). A Design Pattern Language for Effective Professional Development Programs for Clinicians: A Decade of Design-based Research. *Design Principles and Practices: An International Journal*, *5*(4), 553-570.

Robinson, L. & Metcher, J. (2014). Professional Learning and a National Community of Practice for Teachers Leading Local Curriculum. In L. Carvalho & P. Goodyear (Eds.)

The Architecture of Productive Learning Networks (in publication). New York: Routledge.

Slavin, S. J., Schindlwer, D., Chibnall, J. T., Fendell G. & Shoss, M. (2012). PERMA: A Model for Institutional Leadership and Culture Change. *Academic Medicine*, *87*(11), 1481-1482.

Webster-Wright, A. (2009). Reframing professional development through understanding authentic professional learning. *Review of Educational Research*, *79*(2), 702-739.

Webster-Wright, A. (2010). *Authentic professional learning: Making a difference through learning at work.* Dordrecht: Springer.

Zimitat, C. (2001). Designing effective on-line continuing medical education. *Medical Teacher*, *23*(2), 117-22.