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Final Report

Spaces for Knowledge Generation

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Abbreviations used in this report:

ALTC: Australian Learning and Teaching Council Limited
INU: International Network of Universities
IRUA: Innovative Research Universities Australia
QUT: Queensland University of Technology
SKG: Spaces for Knowledge Generation

Executive summary

In the spirit of valuing virtual learning space, the primary outcome of the Spaces for Knowledge Generation (SKG) project is the interactive online site, <http://www.skgproject.com/>. The website is live, and will continue to be updated. It provides links to photo galleries, video interviews, forum presentations, design prototypes, hyperlinked glossaries, an annotated bibliography, and other project resources. This report is a summary of, and companion to, the project website.

The SKG project addresses emerging learning and teaching practices and the extent to which learning environments that students prefer are catered for. The project conducted an international study tour, series of Learning Spaces forums, several project retreats and the development of a number of cost-effective, small scale, good practice learning spaces.

Project deliverables include:

Output 1: *Seven Principles of Learning Space Design.*

Output 2: An *interactive website* with video interviews and presentations, project resources, and a series of animated design prototypes.

Output 3: A practical guide for the design of future-proofed, forward looking, adaptable learning spaces that can support student-directed learning and knowledge generation: Designing Student-Centred Learning Environments: *Six steps for the Production of Future-proofed Spaces for Knowledge Generation.*

Output 4: An edited collection of scholarly articles on Learning Spaces, *Physical and Virtual Learning Spaces in Higher Education: Concepts for the Modern Learning Environment*.

Output 5: *Improved learning space provision* in the participating institutions, and increased student input and awareness of student needs.

Output 6: *Final report* to the Australian Learning and Teaching Council**.**

The SKG project found that students move in nomadic but purposeful ways across a learning landscape of which the university is only a part. Students are typically already enmeshed in a work/home/study continuum, and the problem for the university is to replicate and indeed advance these open and flexible communities on campus. We believe this is best done by providing multiple, welcoming, aesthetic and reconfigurable spaces. We settled on the idea of the 'SKG aesthetic', a framework for the design of future-proofed learning spaces.

The basis of the SKG aesthetic is that learning spaces which invite students to take charge of the configurations of their working environment, and which are wherever possible comfortable, attractive and technologically convenient, help to produce an engaged and considerate community of learners. At the simplest level, an environment which welcomes and encourages active user input also encourages active learning and knowledge generation.

The project was formally evaluated at three points: firstly at the initial reference group meeting by Dr Steve Ehrmann of TLT Flashlight and Professor Philip Long of MIT; and in February and December 2010 by Associate Professor Maree Gosper of Macquarie University.

2. Introduction: 'The problem with expert teaching: From content to design'

The SKG project developed out of the project team's desire to explore students' ideas about the places where they themselves like to learn, using the aids and technologies (high or low) they most prefer. What might such spaces be like? How would students describe them? What do the design and affordances of learning spaces say to students? How can institutions respond to these needs? What sort of pedagogies underpin the idea of learning spaces for knowledge generation? How can technology be incorporated without building in obsolescence and losing low-tech pedagogical advantages? During the two years the project ran, the project team addressed these questions by:

- conducting a full literature review
- interviewing educators and managers in good practice national and international learning centres
- holding several Learning Spaces forums with a range of academic, professional and student participants,
- producing a suite of research-based and practical outputs
- developing several cost-effective and good practice learning spaces.

The design of spaces to develop and support the generation of knowledge by students themselves is an important and neglected field (Temple 2008). Space, a hidden precondition for the processes of organisation in education and elsewhere, can "generate playfully possible realities and real possibilities", such as the development of new discourses, new forms of communication, and even the development of new learner identities (Kornberger and Clegg, 2003, pp. 86-87). Current state-of-the art higher education learning spaces have usually been developed to support collaboration between students and staff and to recognise the importance of supporting student-centred teaching practices. The SKG project builds on this work, addressing emerging learning and teaching practices and the extent to which student preferred learning environments are catered for.

Figure 1. SKG project team at a "Harvard style" lecture theatre, showing the traditional central podium and surrounding raked seating. Harvard University; SKGgallery. (Photo: M Keppell, January 2009.)

Traditionally, the linchpin of learning space design in higher education has been the large lecture theatre, designed to provide one-to-many delivery, with fixed seating directing all attention to the lecturer and the lecture content (Fig.1). There is consensus that the lecture which involves what Alan Guskin described as 'talking at students in fairly large groups and imparting information to them' (1994, p. 20) is not an efficient way to facilitate learning,

particularly for the novice. For the last decade at least there has also been extensive scholarly consensus about the extent learning is shaped by and dependent on learning space design (Brown et al., 1999; Oblinger 2006).

Despite this context, and although the purpose of higher education is the development of independent thinking skills and domain knowledge by and for students, the design, control and organisation of learning environments has primarily been and often remains the responsibility of administrators and teaching staff. With lectures and tutorials still predominant in higher education, the organisation of space and time continues to configure students as receivers of knowledge until the point of graduation, at which time they are expected to produce knowledge of their own. A constructivist theory of education, however, accepts that learners generate meaning and learning out of their own actions and experience, and the task of the SKG project set out to examine models for making student experience more coherent.

The issues surrounding learning space design may influence different groups of students in different ways. For the élite and highly motivated student, spatial issues may be secondary to the psychological and interpersonal experience of learning. Many educators can relate to this young person, and may remember formative experiences in substandard teaching and study spaces. A celebrated example of this phenomenon is MIT's legendary ‘Building 20’, on the site of which the Stata centre was built in 1998. Building 20, ‘constructed hastily in 1943 for the urgent development of radar and almost immediately slated for demolition... still in use [in 1993] and still slated for demolition’ (Brand, 1994, p. 24), is to this day revered as 'a magic incubator', 'the plywood palace', and 'a building with soul'. The attractions of Building 20, however, may have less to do with the charm of substandard facilities, and more with the fact that the building was perceived as extensively customizable. Because of its dilapidated state, occupants felt free to do what they wanted with it, to make it their own, to refashion it for their comfort. This apparently included actions like punching holes in walls for ad hoc wiring and so on. The soul was there because the researchers put it there, and that, it would seem, was what allowed them to use it for exciting intellectual work.

The work we did in the SKG project showed that for today's students, élite or not, the freedom to customize the learning space remains central to the learning experience. In contemporary universities, the drive to customize can be perceived as inappropriate or destructive: a matter of students making a mess by disarranging rooms or unplugging equipment in order to charge laptops for example. A space which announces and invites customizability, however, is a live and welcoming space which signals all sorts of things to learners: principally, we found, institutional respect for the learner on the one hand, and a sense that their contributions were invited on the other. It also provides a metaphor for the experience of ‘building’ and ‘shaping’ knowledge, as the space itself is built and shaped.

The core questions considered by the SKG project concern, firstly, what aspects of design and customizability students experience are important, and secondly, how to design and future-proof such spaces and link them into institutional learning activities. To be able to do this, institutional thinking about learning must address ‘the problem with expert teaching’ and move away from focusing on expert transmission of content to focusing on the generation of knowledge in learners (See Figure 2, Dori & Belcher, 2005).

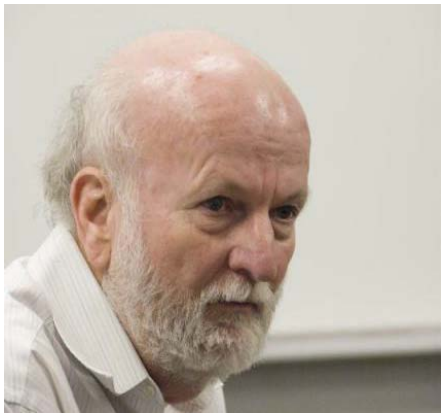


Figure 2. John Belcher, TEAL Centre, MIT, speaks about the problems with expert teaching. (http://www.skgproject.com/2010/11/22/john-belcher-teal-centre-mit/).

Contemporary universities need, and are increasingly building, spaces for formal collaborative learning in innovative classrooms and library spaces, but much—perhaps most—student learning happens in informal settings: the bedroom study, pub, café or library carrel. University-provided spaces of this sort have traditionally been in libraries or the now increasingly rare student common rooms. With student attendance on campus now becoming much more part-time, virtual spaces are taking on more importance: the social networking site, the downloaded lecture listened to on the bus or in the car.

The SKG project set out to consider the common ground of formal and informal learning spaces considered as spaces for student generation of knowledge. The project aimed to chart the shift from thinking about learning as an active rather than a relatively passive process, and the parallel shift from thinking about the question of the content transmitted to the design of the environment which would support learning.

3. In the literature: minds-bodies-places-spaces [1]

Although there is abundant, significant and expanding literature on teaching, learning and knowledge generation beliefs and practices, and an equally extensive strong body of work exploring physical and technological environments and systems for learning and teaching, published research intersecting both is uncommon and 'not well understood' (Temple, 2007, p. 4). Yet, inspection of this nexus reveals it to be a site in which diverse conversations of disparate parties can, and need to, carry on. Frequently, terms like 'interdisciplinary' and 'blended' arise in current educational discourse, but more often than not they are used rhetorically whilst intellectual and technological pursuits continue as usual along discrete paths (Brew, 2008; Huutoniemi, Thompson Klein, Bruun, & Hukkinen, 2010; Selwyn, In press).

Despite the increasingly pervasive, untethered socio-technical *Wi-Fi* interconnections that now pervade worlds of education, business, pleasure, study, work and play, many actual practices and behaviours remain singular and fixedly dislocated in activities and actions that are often inappropriately sited in the past. Also, transport, energy, food and shelter may incorporate specific scientific-technological 'advances', but overall 'progress' still barely keeps pace with real-world needs – if at all – as ever-increasing demands and set-backs weigh heavily on an already over-burdened world (Dourish, 2010). *Spaces for knowledge generation* looks at the 'supercomplexity' (Barnett, 2000) inhering in this situation and identifies the necessity to recognise, accept and understand ways to grow into, rather than exert control over, life experiences.

Our review of literature found a polarised body of work, one hand holding the theoretical and the pedagogical and the other handling the technological and physical. We felt that the powerful interests of teaching and learning knowledge generators and learning and teaching space-place makers needed to be teased apart to show the importance of paying attention to their constituent practical and theoretical, pragmatic and generative overlapping and interacting strands. We set about organising strands around three main areas: discourses *about* the principal constituents; discussions concerning the contexts *for* those constituents, and; explications of perspectives the discourse/discussion emerges *from*.

Areas and strands

about
- principles
- practice
- technology
- environment

for
- physical
- virtual
- personal

from
- research
- theory
- philosophy

[1] Rather than over-burden this report with bibliographic data, we provide here a contextual synopsis that summarises the more extensive annotated bibliography available on the project website.

about

- principles

At the present time we are witnessing a massive investment in the design and build of new schools … The design of these schools will shape the ways in which we think about, experience and conduct education in this country for the next 50 to 100 years. The educational visions upon which they are built will be solidified in bricks and mortar, the learning relationships they envisage will be captured in concrete and glass. The institutions created now will physically encapsulate and determine the ideas it is possible to have about education, learning and learning relationships until the dawn of the next century.

That is a long time to spend working in institutions that do not engage with the educational challenges of the 21st century and which do not exploit the resources that it has to offer. (Rudd, Gifford, Morrison, & Facer, 2006)

Figure 3: 'What if…?' Sketch for cover illustration. (Rudd, et al., 2006)

The above epigram and accompanying images (Fig. 3) appear in a report titled 'What if…Re-imagining learning spaces' (Rudd, et al., 2006). The images are used here challengingly, to re-emphasise the importance of seeing and thinking in different and diverse ways about learning and spaces and to understand them as much more than methodical procedures in structural places. Such an approach is needed to begin to engage with the educational challenges of the 21st century that are often overlooked in the drive to maximise effective/efficient management (Barnett, 2005; Brennan, et al., 2008; Laurillard, 2002). The notion of *re-imagining* reoccurs frequently in the literature and is all encompassing in the seven principles this project articulates – aesthetics, affordances, blending, comfort, equity, flow, repurposing.

- practice

Our essential premise…is that immersive learning is not new and that, as a practical matter, it is useful to view the relatively new virtual world platforms through that lens. By doing so, the premise continues, developers of learning experiences for these spaces will have a large theoretical base upon which to draw, as well as many examples from practice that can be modelled or adapted. (L. F. Johnson & Levine, 2008, p. 161).

A common misapprehension is that changing technology and environments are 'revolutionary' for practice, whereas many changes are evolutionary and necessarily draw on

existing experiences and understandings (A. L. Brown, Bransford, & Cocking, 1999). From this view, modifications in practice become more a matter of adapting and renewing than dismissing and overturning. As a plethora of concerned/critical views on changing practices mix with those of change proponents there is evidence of realisation that mature knowledge and experience is as significant as that of the newly minted (Laurillard, 2002; Trigwell & Ashwin, 2003). Improvements generally rely on both co-existing in on-going generative processes (Graetz & Goliber, 2002; G. Kennedy, 2009).

- technology

> *As recently as a decade ago, classrooms were the primary locus for learning in higher education. Other spaces included the library, the faculty office (for individual mentoring), and perhaps the café in town. But classrooms were by far the single most important space for learning.*
>
> *Since then, a great deal has changed. The World Wide Web has emerged as the primary way most people use the Internet. The Web has spawned a wealth of new, network-based applications, from digital music stores to new venues for scholarly publishing. Indeed, the availability of network access, in one form or another, is today almost taken for granted. Handheld devices have acquired a growing set of functions, providing a telephone, a digital camera, and an operating system running a variety of applications. Laptop prices have declined while increasing in functionality—to the point that their use exceeds that of desktops for most students*. (M. Brown, 2005, p.1)

The 'classrooms' Brown writes of have, in contemporary times, always deployed some technology and today's electronic 'touch-tablet' draws its fundamental form from an 18th century 'writing-slate' ancestor. However, the intervening centuries have seen an increase in technology deployment that is now somewhat commensurate with 'Moores Law' (Moore, 1965). Although the form factor of the physical interface is almost identical, between the slate and the tablet is an almost incomprehensible range and scale of technological evolution. Not only has the technology complexified (Kornberger & Clegg, 2003) the classroom it has shifted the notion of classroom beyond a fixed location (C. Johnson & Lomas, 2005). Where previously the locus of technology was very much the teacher's domain, today's learners treat technology as integral to their learning-teaching relations (L. F. Johnson & Levine, 2008; Li, Locke, Nair, & Bunting, 2005)

- environment

> *The spaces in which we work, live, and learn can have profound effects on how we feel, how we behave, how we perform and can affect different people differently. This is not an exact science — but spaces can also limit the possibilities of our activity, restricting us to old modes of working and thinking. Importantly, the learning spaces we develop have the potential not only to change the way that we work but also to play to our individual difference and preference. If we design our learning spaces with the variety that exists in our learners we will be providing the maximum opportunity for each and every learner to achieve.* (Watson, 2007, p. 260)

We have come to understand how 'environment' refers to a self-organising complex system that human activity must take care about (Pelling, High, Dearing, & Smith, 2008), rather than being a term referencing the surroundings of human interests. In the passage above, Watson (2007) observes how environment affects us individually and differently. Such a view reminds us that complexity comprises (w)holistic understandings about how and why all

are always/already one (Cohen & Stewart, 1994). Respect for this understanding is a characteristic of much of the recent published research we encountered (See, e.g., Brennan, et al., 2008; M. Brown, 2005; Costley, 2007; Grootenboer, Zevenbergen, & Chinnappan, 2006; Kornberger & Clegg, 2004).

for

- physical

> *There has been an important change in the language surrounding educational architecture, which privileges consultation and ensures that in the initial stages of design and the selection of designers and builders, teachers, parents and even students are able to have a voice. However, the case study* [about design for improving school environment] *shows that the message which is heard by designers and architects is no more certain to lead to a complete design solution and still runs the risk of being unrepresentative of the full range of relevant views.* (Woolner, Hall, Wall, & Dennison, 2007, p. 247)

When considering the physical aspects of spaces for generating learning, the interplay of a raft of institutional, political and manifold pragmatic interests (Castells, 1996; Castells, et al., 1999; J. R. Kennedy, Vardaman, & McCabe, 2008) can lead to losing sight of *who* the design is actually *for* (Daigneau, et al., 2005). As Woolner et. al. (2007) put it above, even though there is now more inclusive consideration of diverse voices – the learner's especially – this does not necessarily result in them being heeded. This view proved helpful to us in unpacking and appreciating the many and varied accounts of physical aspects that contribute to the overall complexity (Cele, 2008; Fielding, 2006; Flygt, 2009; Greenwood, O'Donovan, & Rust, 2007; Strange & Banning, 2001; Taylor, 1974).

- virtual

> **Virtual space** *is any location where people can meet using networked digital devices. We should understand virtual space in its widest sense, referring not just to synchronous, highly interactive functions (such as chats, blogs, and wikis) but also to asynchronous functions such as e-mail and discussion threads.*
>
> *Unlike physical spaces, virtual spaces come and go. They can be spontaneous as well as deliberate, synchronous or asynchronous. Participants and their relationships in the virtual learning space can shift rapidly. Participants can also multitask, "inhabiting" more than one virtual space at a time. As networking technology matures and costs for devices such as laptops and handhelds decline, these virtual spaces play an increasingly larger role in all aspects of higher education.*(M. Brown, 2005, p.3, original emphasis.)

Comprehending the reality of the virtual is difficult for those who have not grown up immersed in a technology-mediated world (Castells, 1998; Chang, et al., 2009). Furthermore, the polarising tension between a generation committed to physical reality and an emerging generation open to virtual influences is unhelpful for cooperative and collaborative communication (Baron, 2003; Cazden, 2001; Christie, 2002). Although there is extensive critique of both sites and situations, there is also an unfolding discourse exploring the spaces in between (Davies & Mangan, 2008; Graetz & Goliber, 2002; Laurillard, 2002; Meyer, Land, & Davies, 2008).

- personal

> *Personal learning spaces provide the learning community with a more learner-centred approach to learning by putting the learners in charge of controlling and administrating their learning space … Personal learning spaces are often used for both social activity and engaged work practices and, as such, provide users with the opportunity to include a wide variety of character/learning revealing artefacts in their environment, from work-related documents, to personal opinions expressed in a weblog, to awards and non-academic activities. Also, use of a personal learning space is considered as a continuum, where it will be used during different stages of learning for different purposes.* (Razavi & Iverson, 2007)

Personal learning is an unlikely notion to traditional teachers, who are required to manage and attend to a large class of students. However, evolutionary turns in pedagogy and technology are shifting not only the locus of learning but also its focus (Nespor, 1994; Perkins, 2008). Recent decades have seen a move in the locations and intentions of learning away from classroom-based transmission to more flexible transactional exchanges and on to interactional communication over distances (Perkins, 1999). Whereas the traditional transmission focused environment located teacher and learners in an impersonal, highly structured institutional space, increasing use of technology has enabled and afforded greater flexibility (Oblinger, 2006). This flexibility has enhanced not only the physical environment and its arrangement but has also expanded the teacher learner exchange further towards dynamic interchange whereby both teachers and learners are both learners and teachers, working together to further each other's understandings (Savin-Baden, 2008b).

from

- research

> *We need a better understanding of the role of space in the dynamics of creating more productive higher education communities (potentially involving considerations of institutional academic and managerial organisation and their part in social capital formation, as well as space design and maintenance issues), and its connections with learning and research.* **This should be the subject of further research**. (Temple, 2007, p.6, original emphasis).

The seemingly simplistic notion that to understand how something works requires an understanding of the environment it operates in, is a good example of 'simplexity' (Cohen & Stewart, 1994; Kluger, 2008), whereby complexity is observed in the apparently simple, and *vice versa,* through an often unnoticed complementary interrelationship (A. B. Smith, 2009). According to Paul Temple (2008) this is methodologically difficult, but a much needed area of exploration. A salient observation for us was that small affects were often responsible for large and significant effects for learning. However, in concluding that there are intimate connections between the university, space, and learning, Temple warns: 'Untangling them is perhaps impossible, as well as unprofitable' (2008, p. 239). We are not discouraged by this warning and envision 'untangling' as a continuous dynamic process always/ already adapting with context, environment and circumstances. Untangling in this sense is to understand interrelationships.

- theory

> *[T]he university of the future will continue to use large multi-media auditoriums-but it will also provide much instruction by means of transmission to distant dormitories, fraternities or even homes in other cities. The necessity to assemble for all instruction will be de-emphasised and more opportunity will be afforded for the student to learn when and where it is convenient to him* [sic]. (Thornton & Brown, 1968)

A tendency to think of learning spaces and technology as a 21st century concept is dispelled by reviewing the literature, which reveals significant activity in the 1960s and 1970s on both sides of the Atlantic (P. Smith, 1974). British pioneer Jeremy Taylor (1970) cites 'research work carried out at Rensselaer Polytechnic Institute in the period 1956-62…[that] started with the aid of the Educational Facilities Laboratories a project codenamed 'Reward' to enquire into the efficiency of its processes of instruction.' (p. 189). This early work affirms our notion of principles for practice by outlining examples that align with some of those we have identified, such as, adaptability, repurpose, aesthetics, and the importance of addressing and communication with 'the user of a space…intended to help him [sic] realise the maximum potential of that space' (Taylor, 1974, p. 11). Fast-forward half a century and we find that progress also has its limitations.

> *A dynamic, global economy has been constituted around the planet, linking up valuable people and activities from all over the world, while switching off from the networks of power and wealth, people and territories dubbed as irrelevant from the perspective of dominant interests. A culture of real virtuality, constructed around and increasingly interactive audiovisual universe, has permeated mental representation and communication everywhere, integrating the diversity of cultures in an electronic hypertext.* (Castells, 1998, p. 1)

Intersecting the exciting advances of new technology affordances, some critiques challenge the equality and sustainability of this powerful techno-economic tide (Castells, et al., 1999). These concerns of critical educationists (McLaren, 2000; Stevenson, 2008) open out to broader and deeper theoretical work exploring more eclectic and inclusive interdisciplinary interests, culminating most recently in the work of Maggi Savin-Baden (2008a, 2008b). Discussing ideas and concepts about diverse forms of spaces she introduces affirming notions such as 'threshold concepts' and 'troublesome knowledge', characterising the university as

> *a partitioned-off space where policy and expectations of governments are increasingly seen as given rather than negotiable, contingent or contextual, both in terms of space, place and discipline…However, seeing the university as a site for reclaiming the lost, the new, or the marginalised learning spaces, offers opportunities to stand against the current practices that mitigate against the possibility of such reclamation…will require that we stop seeing the university as a predictable, ordered and manageable space, but instead re-view it as an important site of transformation characterized by risk, uncertainty and radical unknowability*. (2008a, p. 150)

There is a strong theoretical base available to researchers and practitioners in the field that is evolving towards most helpful theorizing from diverse perspectives. If a gap exists, it is in the development of syntheses of this work.

- philosophy

> *Not many years ago, the word 'space' had a strictly geometrical meaning: the idea it evoked was simply that of an empty area…To speak of 'social space', therefore, would have sounded strange…No limits at all have been set on the generalization of the concept of* mental space: *no clear account of it is ever given and, depending on the author one happens to be reading, it may connote logical coherence, practical consistency, self regulation and the relations of the parts to the whole, the engendering of like by like in a set of places, the logic of container* versus *contents, and so on.* (Lefebvre, 1991)

Henri Lefebvre's excursion into a philosophy of space is especially useful for us in bringing more inclusive, apprehensible and equitable understandings to the nebulous and expansive notions the word 'space' suggests. Perhaps the most helpful idea Lefebvre offers our work on spaces is the association with the notion of its production: '*(Social) space is a (social) product'* (1991, p.26, original italics). Furthermore, production of (social) space gives rise to spatial practice, which 'is lived directly before it is conceptualized' (p. 34). Using D. W. Winnicott's (1971) notion of potential space, Andrew Metcalfe and Ann Game (2008) also upset the idea of Euclidean space to propose a phenomenological space that becomes recognisable through relation (p. 18).

From a broader perspective, we have found recent philosophical turns and moves in what can be loosely called poststructuralism to be useful. Poststructuralism perceives change as emergent and inclusive rather than developmental and particular. An illustration of this is Gilles Deleuze and Felix Guattari's (1987) proposal to re-imagine the archetypical 'tree' of knowledge as a rhizome (a plant root mass), thereby offering another appreciation of knowledge that is closer to the hyper-visual-text of the internet than that of a shelves of library books (See, Fig. 4).

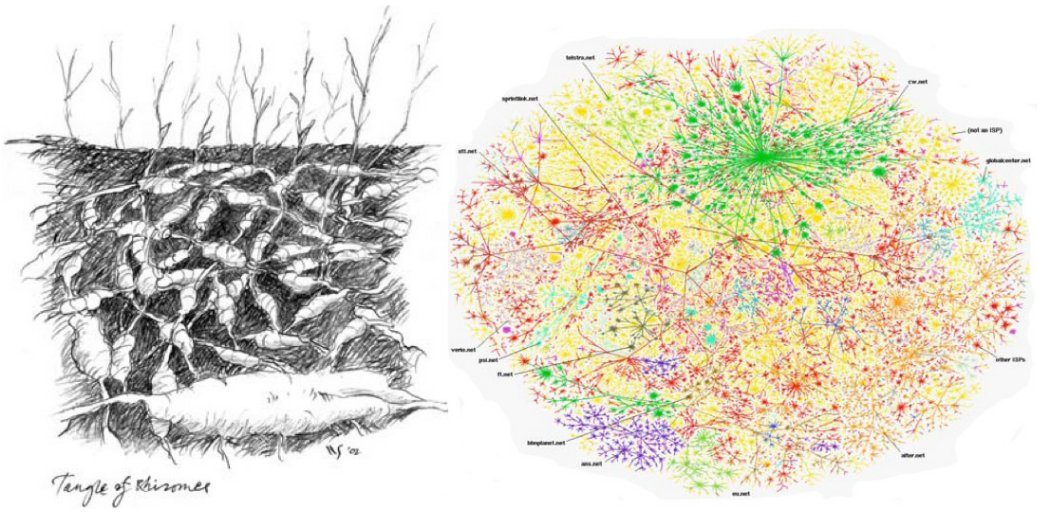


Figure 4: Illustration of a rhizome and a map of the Internet.
(Drawing, W. Sellers; Map, W. Cheswick, http://www.cheswick.com/ches/map/gallery/)

Concluding thoughts

There is substantial body of work dating from the late 1950s that has contributed to a continuum of understandings about the notion of space that engages with complexities of minds-bodies-places-spaces as an aspect of extant and generated knowledge, particularly in relation to technology. The literature demonstrates an evolutionary pattern that affirms a view of present circumstances as an emergent condition of complexity (Rocha, 1999) within which understandings and actions are always negotiable and negotiated. The recent notion

of simplexity (Kluger, 2008) is a helpful concept in coming to terms with how rapid and enormous rates of complex technological change can be paradoxically simple to understand. An example of this is the touch-tablet, which sustains the functional simplicity of its 19th century forebear through the deployment of and engagement with a universe of technological and intellectual complexity. There remains today one generation whose education began in an environment where a blackboard and chalk were the primary classroom technology and another generation whose education is literally at the tips of their fingers. Between the two is a conceptual chasm that is ignored at our peril.

4. The project: history, methodology, methods and events

The SKG project was based on the philosophy that learning, research and study, are learner-generated, that the facilitation of learning must make use of technologies and approaches favoured by students, that learning spaces must be organised to reflect learner-generated aspects of learning. The context of the learning experience will therefore change over time as technological, economic, social and interpersonal developments, including the exploding importance of peer learning through 'networks of knowledge builders' (Nespor, 1994, p. 7), influence the types of learning spaces that learners and teachers require to achieve their learning outcomes. New technologies, such as mobile computing devices, and new forms of learning, such as collaborative work, may require 'very different physical learning environments from those required for teacher-centred activities' (O'Rourke and Powell, 2006, p. 8).

The SKG project was funded by a grant from the Australian Learning and Teaching Council at a time when learning space design was a hot topic and there were many projects directed to thinking about the area. The initial project team consisted of Associate Professor Kay Souter, Matthew Riddle and Stephen Jones as project manager (all of La Trobe University), Professor Mike Keppell of Charles Sturt University, Robert Bienvenu of Kneeler Design Architects, and Chris Feil of Apple Inc. Others joined the team later on, namely: Ross Ramus from Kneeler Design Architects, Dr Warren Sellers taking over as project manager and Natalie Pirotta as research assistant. The SKG project began by situating the project in the landscape of other work on the topic, particularly the massive Oblinger collection, *Learning spaces* (Oblinger, 2006), the report of the British Joint Information Systems Committee, *Designing spaces for effective learning: A guide to 21st century learning space design* (2006), and the ATLC project, *Designing next generation places of learning: Collaboration at the pedagogy-space-technology nexus.* (completed 2008).

The SKG project undertook a study tour of best practice learning spaces and held a series of Learning Spaces Forums involving undergraduate and postgraduate students, academic and administrative staff, and experts in the areas of physical and virtual learning space design. The intention was to learn from and build on the work of other projects and institutions, and to involve students in project work as co-researchers. The project also set up a large reference group, made up of students, academics and other professionals from around Australia. The third 'pillar' of the project was the series of forums we held, intended to generate primary data from the mix of project activities, including keynote addresses, panel discussions, focus group work, and sessions to generate prototypes and test out ideas. Much of this work was recorded, either on video, or via materials generated by the events, and is available on the SKG project website <http://www.skgproject.com/>.

Spaces for knowledge generation by students: Student driven design

Learning space design has often focused on staff perceptions of teaching needs with some research into student learning. The SKG project focused specifically on student agency in learning and on gaining student input into learning space design as participants in steering the design process and participating in the design process itself as co-researchers. It is relatively easy to envisage universities where mobile devices such as smart phones or iPads can support learning and lifelong access to education for students in formal or social spaces on campus, in the café, at work or in their bedrooms late at night. We were interested also to

harness student input and imagination in order to maximise the potential of universities to support contemporary students and to adapt to change.

Learning and teaching strategies continue to evolve in part in response to changing student populations and to take advantage of new and emerging technological tools, the latest of which are the smart phone, the netbook computer and the tablet computer. Many students routinely use technologies in their learning that are neither provided for nor appreciated by universities. Concurrent student input is an essential ingredient in an effective design process to develop spaces which account for student modes of learning. The pace of change requires a framework for ongoing development that enables and supports student learning and does not inhibit it.

Context and characteristics of La Trobe University

La Trobe University is a multi-campus university serving metropolitan and regional Victoria. It has a number of off shore programs, partnerships and exchange links with over 250 institutions in over 40 countries and is a founding member of the International Network of Universities (INU) and a member of the Innovative Research Universities Australia (IRUA). In 2008, infrastructure had not been updated for many years, and learning spaces were not appropriate to current needs: there were very few informal learning spaces. The Strategic Plan for 2008-2012 identified promoting equity of access and new teaching approaches to enrich students' experiences and enhance employment skills and active citizenship as core priorities. In relation to learning spaces it states, "The University will… actively expand this (building infrastructure) through innovative commercial and research partnerships. Facilities will be fit-for-purpose and be able to quickly respond to learning and teaching needs and research practices" and "By 2010 the University will… develop best practice and innovative design principles to maximise support for learning and teaching, research and student needs…". By November 2010, La Trobe had launched its twenty year master plan for the Melbourne and Bendigo campuses.

We were fortunate that the SKG project coincided with the planning period of the La Trobe University master plan. Members of the Library Redevelopment committee and the infrastructure planning group attended forums and built some of the emerging insights into design. Similarly, Charles Sturt University was able to use the insights of its student representatives to help develop aspects of their student accommodation, including low cost ones, like providing writing surfaces in informal spaces: a student rep sourced second hand white and blackboards to put up in student kitchens, which was an instant success.

Approach

The project established a set of institutional partners which ensured a range of relevant expertise in education, design and technology with cross-sector national and international input from an active reference group. At the core of this project is a systematic applied research methodology that exemplifies the knowledge generation model upon which it is built. The methods that make up this approach are collaborative and consultative with the aim of eliciting new and innovative ideas. The major research activity was to generate primary data as a result of a strategic mix of project activities involving academic and administrative staff, education experts and current undergraduate and postgraduate students.

Methodology

This table summarises the methodology processes and constituents (project proposal, p. 4).

Data sources	Interpretation	Deliverables
Existing studies, project reports, papers, case studies, design documents, technical information, etc.	Selection and organisation	Literature review Case study compendium References & contacts
Invited papers, recordings and selective transcripts of panel and plenary discussions, 'prototyping workshops', 'beyond the comfort zone' activities	Selective transcriptions, thematic analysis and revision of design ideas from working groups	Papers Prototype designs
Case study document and prototype designs	Cross-case analysis and comparison	Design principles
Transcripts and notes from reflective exercises at Learning Spaces Forums	Coding and qualitative analysis	Informs evaluation

Methods

Literature review

A wide range of secondary data was collected through desk research conducted by team members. This aimed at building a collective understanding of the current landscape, particularly in relation to recent developments within Australia and overseas in the area of flexible learning spaces. This included relevant studies, project reports, papers, case studies, design documents and technical information. This work resulted in the development of a literature review in the area of knowledge production and student learning spaces.

Videotaped interviews & field notes from Study Tour

The SKG project team conducted a study tour in January 2009, which included site visits at Stanford University, Apple Inc., MIT, Harvard, Kings College London, The Open University, TU Delft and Sheffield Hallam. Videotaped interviews were conducted at most of these locations, and photographs and field notes were taken. Videotapes were then selectively transcribed and these transcripts and notes were organised into themes.

Case studies

The study tour notes and photographs were then compiled into a series of illustrated case studies and organised into themes.

Prototype designs

Members of the project reference group and forum participants, including staff and students, developed designs of future learning spaces during 'prototyping workshops' conducted at each of three forums. These designs include posters and illustrations.

Invited presentations

Well known thought-leaders in pedagogy and learning spaces were invited to present on key themes at each forum. These presentations were videotaped to be used as podcast resources for the SKG project website and fed into the development of design principles.

5. Case studies: the study trip and local experiences

Five members of the Spaces for Knowledge Generation project team conducted a study tour during January 2009 aimed at collecting case studies of a range of different learning spaces from tertiary institutions renowned for their teaching excellence. Site visits, meetings and videotaped interviews were conducted at a variety of places including: Stanford University, Apple, Harvard University, MIT, Kings College London, University of Cambridge, The Open University (UK), Sheffield Hallam University and TU Delft (Netherlands). Photographs and reports are available on the SKG website, www.skgproject.com

Figure 5. The SKG team interviews Rich Holeton at Stanford University, January 12 2009.

During these site visits we conducted a series of semi-structured interviews with people involved in the design and management of learning spaces and technologies at each institution, asking them about what has and hasn't worked in each of the spaces. (See, Fig 5). Clips from these interviews may be viewed on the project website. <http://www.skgproject.com/category/interview/> We were particularly interested in innovative collaborative and informal learning spaces.

The major findings that came out of this tour were reported in our forums, and worked to develop insight and prototypes there. Common to all the institutions was the intention to provide flexible and comfortable spaces where the technology is as inconspicuous as possible. In the words of Robert Emery Smith, the Stanford Center for Innovations in Learning Director of Technologies at Wallenberg Hall, 'the teacher is the irreplaceable element' in the high tech learning space: <http://www.skgproject.com/2010/11/24/robert-smith-stanford-the-teacher-is-key/>

Local Experiences

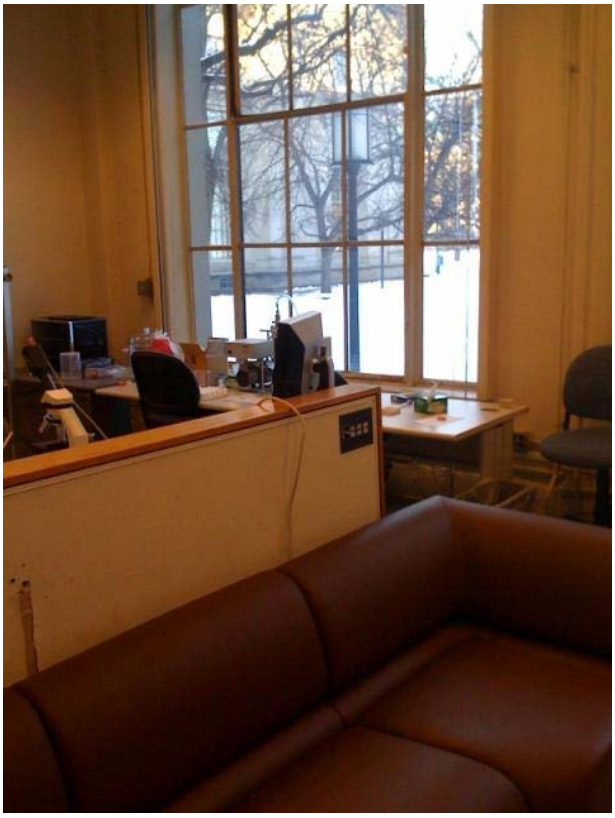
The project was able to use the experiences of the study tour and the first forum to develop several cost-effective local learning spaces.

Room 228, the Humanities and Social Sciences Learning Room:

The La Trobe team used the insight from the study tour to develop and refurbish a large, dilapidated room as a learning space. This room had degenerated into a storage space and tea room used by a small number of administrative staff. It was dirty and oddly shaped, but had a small kitchen attached and an inspiring view across the campus moat system. The room has since become a best practice collaborative learning space used to develop teaching approaches, and is much in demand across the faculty and indeed the university. Because it seemed likely that the building might be redesigned as part of the university master plan, we were anxious not to spend too much money either on the structure or on very expensive technology with built-in obsolescence.

The project team learnt from the study tour that the physical comfort and re-configurability of the room is paramount. Bob Smith of Stanford explained that the most valuable technologies are the tables and chairs, which are light, comfortable and extremely easy to reconfigure. Katie Vale of Harvard explained that staff and students really value a range of technologies. The education team at Apple described the importance of a variety of spaces for public and private work. The MIT team described the importance of an aesthetic dimension in student experience. Philip Long discussed the value of the local factor. In designing the Learning Room, we tried to bring all this together.

Accordingly, we spent most of our small budget on the Steelcase chairs and tables and a set of 'Huddle boards' (small ultra-light–weight whiteboards that can be used by breakout groups) so much loved at Stanford (and by our staff and students also). We developed the 'chalk-to-plasma' continuum favoured by Harvard, including a blackboard, and a Smartboard. Much as we would have liked a videoconferencing facility to allow for multi-campus hookups, for example, the 'bargain' $30,000 price tag (which involved the university bearing most of the cost) ruled that out. Instead, a class set of laptops with VOIP capacity allows students to communicate with a class doing the same subject at another campus much more cheaply—and of course has many more possibilities. We renovated the kitchen to provide some of the affordances valued by the UQ 'Next Generation Learning Spaces' project <http://www.uq.edu.au/nextgenerationlearningspace/>. We chose a room with a striking view of La Trobe's beautiful bush campus (pelicans sometimes fly past), and gave it a bit of extra pizzazz by including an ochre-coloured wall, to provide a touch of the edgy aesthetic we admired in the Stata Center at MIT. There are couches placed in the angles of the irregular room to provide eddy spaces in the corners of the irregular room, as we saw in the Stata Center and the Freshman Nanotech Lab at Harvard (Fig. 6).



Money spent on the physical structure was limited to painting the walls, sun-block blinds for the windows and new carpet. There was a dramatic improvement in the appearance of the room. <The Humanities and Social Sciences Learning Room> was launched in 2009, and is an excellent example of the application of our SKG Seven Principles of Learning Space design (CAFÉBAR), <http://www.skgproject.com/learning-spaces-toolkit/design-principles/> (See, Fig. 7). It is extremely popular with staff and students across the university, and has been used in innovative cross-campus classwork <www.skgproject.com/learning-spaces-toolkit/the-latrobe-learning-room/>. The influence of the various learning spaces the project team encountered on the study tour is clear.

Figure 6. The Harvard Nanotech Lab, showing lab bench in the background and huge leather couches for breakout discussion in the foreground. The lecturer felt the view of the snowy courtyard was a major learning asset.

Figure 7. The La Trobe Faculty of Humanities and Social Sciences Learning Room, showing flexible furniture, huddleboards, comfortable chairs and electronic whiteboard. The room also has expansive views over adjoining trees and stream. (Photo P. Goldacre)

Figure 8. The La Trobe Faculty of Law and Management collaborative teaching and learning space refit based on SKG principles. (Photo M. Riddle)

Collaborative Teaching Spaces in the Faculty of Law & Management: Room MB-362A

As part of a major refurbishment of the third floor of the Martin Building at La Trobe University, SKG project team member Matthew Riddle developed a proposal based on SKG principles of learning space design and using observations from the study tour and ideas generated from the project forums (Fig. 8). This proposal was approved in 2009 and works completed during 2010. A second room, DWB-222, is now being fitted out with similar features for use in 2011.

The new collaborative teaching and learning space has the following key features:

- support for up to 25 students working collaboratively in teams at tables
- two break out spaces for informal learning or observations
- nine flip top tables that can be quickly and easily reconfigured for separate group work, or in a U-shape for meetings
- a trolley with eight cross-platform laptops for use in classes
- two mobile collaborative workstations (MoCoWs) to facilitate collaborative teamwork;
- ClassSpot interactive classroom software;
- an adjoining board room with moveable wall to accommodate classes of up to 40 in the combined space, also fitted out with flexible furniture; and
- five ‘Huddleboard’ whiteboards with ledge and trays for storage and display.

6. The project meetings: reference groups, forums, retreats

Reference Group meeting, November 2008

The Spaces for Knowledge Generation project began on 26th November 2008 with a full day meeting of its Reference Group at La Trobe University. The program <http://www.skgproject.com/wp-content/uploads/2008/12/skg_ref_program.pdf> included morning presentations from Kneeler Design, Professor Gráinne Conole (Open University and Professor Phil Long (UQ and MIT) & Dr Steve Ehrmann (TLT and Flashlight Program). The afternoon included a series of breakout sessions on the topics of 'active learning models', 'independent and informal learning' and 'designing with and within institutions'. These were facilitated by members of the reference group and Dr Cyprien Lomas (then Director of The Learning Centre in the Faculty of Land and Food Systems at the University of British Columbia, now Associate Professor and Director of Research, CEIT, The University of Queensland). The reference group included project team members as well as staff and students from a range of institutions including La Trobe, Charles Darwin, Charles Sturt and Victoria Universities.

Dr Steve Ehrmann and Professor Philip Long provided formative assessment of this event.

The first forum of the Spaces for Knowledge Generation project, May 2009:

This forum was held on 28th May, 2009, and was structured around lectures and discussions. The SKG project team gave a presentation on the Study Tour, conducted in January to set the scene for the day. Professor Gráinne Conole from the Open University, UK, addressed the forum on the topic of personal learning environments. Her presentation Personal Learning Environments: interface between physical & virtual spaces is available in PowerPoint format on the project website <www.skgproject.com/project-reports/first-forum/>.

Dr Rosaria Burchielli presented an example of Evidence Based Learning to a break out session on collaborative learning spaces. Her presentation on the redesign of the subject Business Ethics, EBL for Business Ethics, is available on the project website.

The second forum of the Spaces for Knowledge Generation project, October 2009:

The program for this forum largely consisted of Workshop activities and focus group discussion <www.skgproject.com/project-report/second-forum/> Students facilitated most of the activities, testing end exploring the hypotheses generated in earlier forums. Large amounts of data were captured and tabulated, and are available of the project website.

It was clear from the materials produced and the discussions that students value ease of access, material comfort and the necessary affordances of Wi-Fi, access to shelter and food, and perhaps above all, a friendly and readily reconfigurable ease of flow. It was also interesting that the student members of the group took for granted, and explained to the forum, ideas that were surprising to some of the academic staff, such as the reluctance of many students to spend much time on campus.

First project retreat, Charles Sturt University, 24-25 August 2009

This meeting of the project team allowed us to regroup and reorganize the project direction. We toured the innovative green spaces at the Charles Sturt Thurgoona campus, and were shown around the student accommodation (some of which had been influenced by the project) by the students who had attended the first and second forums.

Second project retreat, La Trobe University, 18 – 19 March 2010

This was a meeting with the evaluator, Associate Professor Maree Gosper, Macquarie University, where we set the final projects goals. Associate Professor Gosper provided formal evaluation of the project at this retreat.

7. Findings and design principles

Looking back at case studies, looking forward to principles and prototypes

The case studies fed into major project events to influence the development of principles and prototypes.

November 2008

After the first meeting of the Reference group for the ALTC project on 26th November 2008, 'Spaces for Knowledge Generation: a framework for designing student learning environments for the future', the reference group formulated a number of initial practical rules and issues.

Design for Active and Collaborative Learning

1. importance of withholding 15% of building budget to modify and adjust spaces after construction
2. learning space designs must be context-specific
3. spaces should be 'future proofed' and non-deterministic: that is should incorporate maximum adaptability and not be unduly dependent on current technology
4. students' own technologies and technological preferences should be supported
5. the importance of student-driven design: generally speaking this is not done well, and we should be seeking student input
6. the crucial elements of informal learning: comfortable seating; protection from weather; access to power; Wi-Fi; extended hours of access; access to food; lockers; and reconfigurable spaces, including lighting and furnishings
7. the need for a systematic way to design informal learning
8. 'Sandpit' or experimental spaces should be used to develop and test prototype designs. This also supports the professional development of teaching staff
9. desperate need for a range of spaces to support (formal) active learning.

This set of rules was developed from discussion and research: it represented a summary of available views as processed and reworked by the reference group.

January 2009

The study tour and student input at the two project forums modified and developed this helpful but pragmatic position.

Metaphors of Learning Spaces

Particularly influential was Apple's use of the work of Joseph Campbell (1975) to explore the concept of the types of learning spaces for different useful for different sorts of work. Apple described four sorts of spaces:

- The Campfire: a structured space in which students face a teacher and listen to traditional knowledge;
- Watering Hole: a space where students can collaborate informally;
- Cave: a private space for reflective work;
- Mountaintop: a space for presenting work to large numbers of others.

The project team felt that these very persuasive metaphors had a distinctively North American and perhaps West Coast flavour to them. The issue for us became to understand how these metaphors might relate to Australian learning space design.

Timescapes for Learning in an Australian Context

February 2009

The Australian context require less emphasis on the organised functions of camping and more on the time element underlying and shaping learning spaces and the fluidity of the spaces produced. To reflect the shifting nature of learning spaces, we are using metaphors drawn from the seasonality of the Australian landscape: the beach, the seasonal rivers and wetlands, the high plains. We also rely on the idea of purposeful moving across meaningful spaces, rather than static habitation of fixed structures.

The Australian context suggested three levels of learning space:

- The Coast (social/semi-permanent/reformable)
- Eddies (moving, reforming)
- Plateaus, tablelands (generative/didactic/permanent)

We used Apple's powerful and suggestive metaphors of learning spaces to shape a metaphor for the Australian context of learning. In short, our attention was drawn very strongly to the changing landscapes of Australia and the value of that in the design of learning spaces.

In our subsequent thinking about the concepts underpinning learning space design, we emphasised the time dimension and student movement between reconfigurable spaces. This proved to be crucial for the work in the second forum, where students repeatedly emphasised their movement between different parts of their lives: they do not simply appear *at* a 'campfire', they move purposefully but in not entirely regular ways between potential learning spaces which can be used differently each time. Such student behaviour is nomadic not in the sense of purposeless wandering but in the sense of appropriate but not entirely predictable movement across a known landscape saturated with meaning. Students in our forums describe their movement between home, university and work in this way.

Learning Spaces Toolkit

<http://www.skgproject.com/learning-spaces-toolkit>

April 2010

Seven Principles of Learning Space Design

After two further forums, and by the time of the final project retreat, the project had established seven overarching principles that need to be addressed. These were more overarching than the principles in the initial report.

The SKG project established seven broad principles of learning space design which support a constructivist approach to learning: that is, principles which support a learning environment which is student-centred, collaborative, and experiential. These have the mnemonic CAFÉ BAR, which is quite appropriate, granted the student appreciation of comfort.

Comfort: a space which creates a physical and mental sense of ease and well-being.

Aesthetics: pleasure which includes the recognition of symmetry, harmony, simplicity and fitness for purpose.

Flow: the state of mind felt by the learner when totally involved in the learning experience.

Equity: consideration of the needs of cultural and physical differences.

Blending: a mixture of technological and face-to-face pedagogical resources.

Affordances: the "action possibilities" the learning environment provides the users, including such things as kitchens, natural light, Wi-Fi, private spaces, writing surfaces, sofas, and so on.

Repurposing: the potential for multiple usage of a space.

The project also generated a hyper-linked Practical Guide to the production of Learning Spaces.

Designing Student-Centred Learning Environments:

Six steps for the Production of Future-proofed Spaces for Knowledge Generation

1. Identify constraints and opportunities**,** including student needs

   This will include considering budget possibilities, institutional regulations, staff sensitivities about space use, student needs and wishes. It will be useful to run some focus groups.

2. Research other good practice frameworks and solutions to your needs

   These might include ALTC resources, institutional websites, published findings such as journals and books. Visits, either virtual or physical to good practice learning spaces are useful.

3. Invite speakers who have travelled the road before you

   Your research into good practice frameworks should indicate who some of the major players in the field are. It can be useful to have them visit your institution to talk about their experiences, not least because this helps to develop a core group of informed participants. Appropriate invitees might include AV and Buildings and Grounds staff, student leaders, educational designers, innovative teachers, Teaching and Learning Managers, Heads of Departments etc.

4. Run concept and development workshops with some student facilitation

   Now you have a sense of what the potential is and what other responses have been, you can begin to explore your own needs. What sorts of spaces are required? What sorts of learning experiences are planned? What are student needs? What does the climate/culture/institutional structure require/allow?

5. Collate your findings and plan your response.

   Bring it all together: what sort of spaces will fit the bill? How will you go about resourcing the production? Who will do the gopher work?

6. Design and implement your concept**.**

   Draw up layouts; build in the SKG Seven Principles of Learning Space Design; plan power needs, technological needs, social needs, furniture, refurbishment, re-configurability, access security. Order fittings, organise refurbishment.

Launch Space! These guides are available in an interactive form on the project website.

8. Design prototypes of learning spaces: four models

Kneeler architects based their animated collages modelling learning spaces on the timescape narratives provided by the project team. These design prototypes can be found on the project website after February 2011. <http://www.skgproject.com/category/design-prototypes/>

8.1 Active and collaborative learning spaces.

Roughly square in shape, flat-floored, with about 3 square metres per person.

Reconfigurable, with sliding or folding doors opening to other spaces, such as an adjoining room or 'milling' space, or outdoors when possible.

Light, moveable, comfortable chairs and light, foldable tables.

Basic kitchen facilities such as provision for boiling water, a refrigerator, a sink.

Natural light.

Multiple writing surfaces.

Power access, ideally in-floor, and Wi-Fi.

Some form of collaborative internet access such as a Smartboard or Moocows (Mobile conferencing units) at group work tables. The Moocows were developed by QUT to support group collaboration and consist of a NEC screen with touch overlay mounted onto a trolley with wireless internet and keyboard, and fitted with a Logitec camera and microphone for recording and video-conferencing.

8.2 Outdoor learning spaces

Shelter from sun, wind and perhaps rain.

Power and Wi-Fi.

Comfortable seating.

Writing surfaces such as heavy glass screens.

8.3 Eddy spaces

Small spaces for one or two people to use for short periods (See, Fig. 9).
Basic seating, perhaps floor based such as a carpeted ledge, or a 'perch'.
Power outlet, Wi-Fi.
Small writing surface, such as a ledge.
Indoor and outdoor.
Positioned in 'waste' space, such as corners of buildings, gardens, walkways.
Ideally with some food outlet nearby, such as a coffee cart.

Figure 9. Student in an eddy space. (Photo K. Souter)

8.4 Private spaces

Spaces for private group work.

Power, Wi-Fi.

Writing surfaces.

Barriers to sound and sight, such as movable screens (ideally writing surfaces) behind couches or at the end of booths

A shared table space, either writing height or coffee table height.

Principles of Learning Space Design to maximise learner agency

	Physical	Virtual	Blended
Indoor	Reconfigurable: roughly square, flat floor, light and movable furniture and walls, multiple writable wall surfaces. Comfortable, and aesthetically interesting.	Class sets of technologies, including recharging points, storage points.	Reconfigurable. “Plasma-to-chalk” continuum of technology. Spaces arranged so as to facilitate lines of sight, student interaction. Multiple power outlets.
Outdoor	Shelter, comfortable seating, power outlets; small ‘eddy’ spaces	Wi-Fi, shelter, group and individual seating.	Wi-Fi, shelter, reconfigurable group and individual seating.
Formal	Possibilities of different sorts of formal learning: collaborative, active.	Adequate training; technological and real-time support.	Adequate training; technological and real-time support. Reconfigurable spaces and furniture to facilitate lines of sight, student interaction. Multiple power outlets. Mix of didactic spaces and interactive areas.
Informal	Ease of access, security, variety of noise levels. Small ‘eddy’ spaces.	Spaces and furniture to facilitate group and individual work and socializing.	Reconfigurable spaces and furniture to facilitate group and individual work and socializing. Multiple power outlets. Sofas. Access to café or kitchen facilities.
Social	Movable furniture, inviting spaces, multiple writing surfaces, access to food preparation facilities (hot water, microwaves).	Spaces and furniture to facilitate group work and socializing.	Spaces and furniture to facilitate group and individual work and socializing. Multiple power outlets. Sofas.
Private	Large numbers of individual spaces for one or two people (eddy spaces).	Computer labs, furniture to facilitate individual work and socializing.	Computer labs, furniture to facilitate individual work and socializing.

9. Conclusions: Student-generated and future-proofed design

The SKG project found that students move in nomadic but purposeful ways across a learning landscape. The university is only a part of this. Students are always already enmeshed in a work/home/study continuum, listening to university podcasts in the train, face-booking in lectures, SMS-ing classmates while cooking dinner. The problem for the university is to replicate and indeed advance these open and flexible communities in the classroom.

We believe this is best done by providing multiple, welcoming, aesthetic and reconfigurable spaces. Finally, we settled on the idea of the 'SKG aesthetic', a framework for the design of future-proofed learning spaces. Our set of Seven Principles of Learning Space Design are based on the interpersonal needs of communities of learners rather than tied to contemporary technology or particular pedagogies. Some of the most relevant of these are given below.

9.1 Inter-generational understandings:
Today's students generally spend less time on campus than earlier generations, both because they are often mobile and also because they often work long hours. They are often attached to mobile technology, particularly phones and laptops, and desperately need places to recharge them. Universities need to cater for this. Many students may not have their own computers and need 24 hour access to learning commons with computer access. They expect to be able to customize their study environment.

9.2 Home/work tensions:

Students have multiple demands on their time, and often need 24 hour access to learning spaces.

9. 3 Death of the union/integration of the commercial:
With the loss of student union fees in Australia, commercial entities have become more a feature of student life. This leads to some bizarre practices, such as 'No Studying' signs in university cafes. Universities must provide learning spaces that allow students to integrate food and study, and this involves generating systems for keeping those areas relatively clean and tidy.

9.4 Open and flexible spaces, open and flexible communities:
The basis of the SKG aesthetic is that learning spaces which invite students to take charge of the configurations of their working environment, and which are wherever possible comfortable, attractive and technologically convenient, help to produce an engaged and considerate community of learners. Our forums showed that students, and probably everyone, read institutional generosity in the provision of comfortable, welcoming, convenient and attractive learning spaces as a proxy for respect. Unsurprisingly, students and staff respond to that respect with the enthusiasm which is a necessary precondition for the generation of knowledge. At the simplest level, an environment which welcomes and encourages active user input also encourages active learning and knowledge generation.

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Appendix 1: Dissemination activities

Invited presentations:

Physical, blended and virtual learning spaces in higher education. Learning Space Design Summit. Sydney. (November, 2010).< http://www.slideshare.net/mkeppell/learning-space-design-summit>

Blended learning: Redefining the space. National Learning and Teaching Forum, Melbourne. (October, 2010). <http://www.slideshare.net/mkeppell/national-learning-and-teaching-forum-redefining-blended-learning>

Distance learning architecture. National Learning and Teaching Forum, Melbourne. (October, 2010). <http://www.slideshare.net/mkeppell/national-learning-teaching-forum-distance-learning-architecture>

Affordances of physical and virtual learning spaces in higher education, Charles Darwin University, (June, 2010). <http://www.slideshare.net/mkeppell/affordances-of-physical-and-virtual-learning-spaces-4797646>

Physical and virtual learning spaces in higher education. Macquarie University, Sydney. (April, 2010).

Considering learning space issues. Ascilite/TLT collaboration. Webinar presentation. <http://tinyurl.com/tltg-ascilite> (December, 2009).

Creating physical and virtual learning spaces: Examples and ideas. Ascilite/TLT collaboration. Webinar presentation. http://tinyurl.com/tltg-ascilite (November, 2009).

Affordances of physical and virtual learning spaces in higher education. Australasian Council on Open, Distance and e-learning (ACODE). The University of Queensland. July 13, 2009, Brisbane. (July, 2009).

Teaching and learning spaces: Meeting multiple needs. Panel Session. Australasian Council on Open, Distance and e-learning (ACODE). The University of Queensland. July 13, 2009, Brisbane. (July, 2009).

Conference presentations:

Spaces for Knowledge Presentation. The Sixteenth International Conference on Learning. University of Barcelona. (July, 2009).

University presentations:

Researching and designing collaborative Learning Space. La Trobe University Learning Space Design Symposium. (September, 2010).

University workshops:

Learning Space Design Workshop, La Trobe University, July, 2011.

Designing Learning Environments for the Future, Queensland University of Technology, July 8, 2011.

Designing Learning Environments for the Future, University of Technology, Sydney, July 21, 2011.

Designing Learning Environments for the Future, Open University, UK, September 2011.

Designing Learning Environments for the Future, University of Minnesota, September, 2011.

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Spaces for Knowledge Generation: A Framework for Designing Student Learning Environments for the Future

ALTC Project number PP8-849

Project Leader: Associate Professor Kay Souter, Faculty of Humanities and Social Sciences La Trobe University

Partner Institutions: Charles Sturt University, Kneeler Architects, Apple

Project Team: Professor Mike Keppell (Charles Sturt University), Mathew Riddle, Warren Sellers, Natalie Pirotta (La Trobe University), Chris Feil (Apple,) Robert Bienvenu and Ross Ramus from Kneeler Design Architects.

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1. Purpose of the Report

This is the final evaluation of the Spaces for Knowledge Generation project. Its purpose is to provide an overall perspective of the Project to determine whether it has achieved the intended outcomes in accordance with ALTC goals of value for money, high impact and future looking. The evaluation has been conducted and the report prepared by Associate Professor Maree Gosper, Macquarie University.

2. Background to the Project

The project aims as stated in the project documentation (ALTC application) are to:

- provide higher education institutions tools to inform, guide and support sustainable development of learning and teaching spaces and practices;
- locate the role of universities within the broader learning environment of contemporary students in relation to virtual, physical, technological and cultural learning space provision;
- advance support for student directed learning and knowledge creation in university learning and teaching practices;
- provide guidance for universities to enable students to integrate their university situated learning within their broader learning environment; and
- provide a model for designing student learning environments that is future focussed and sustainable for the medium term in a quickly evolving teaching technological context.

The intended outcomes are to promote strategic cultural change to university teaching practices and physical changes to campuses to advance learning and teaching. Specific outcomes include:

- a sustainable institutional model for designing leading edge learning spaces for students aligned with current and emerging learning and teaching practices;
- a practical guide including principles for institutions to design forward looking, adaptable learning spaces that can support student directed learning and knowledge generation;

- increased awareness of student needs and perceptions in relation to university learning space provision and increased student input;
- improved learning space provision; and
- increased adoption of teaching practices to support student directed learning and knowledge production.

3. Context of the Projects Operation

The original duration of the project was from November 2008 to July 2010.

The initial plan as outlined in the project proposal was for development over three phases:

Initial Phase: Nov 08 to May 09	• Project set-up: Initial meetings with external facilitator, reference group, partners external evaluator on goals, evaluation strategies and activities. Ethics approvals and personal releases obtained • Activities: Sharing of materials/desk research amongst reference group; a literature review; Apple, MIT and Stanford visits; Needs analysis conducted and research proposal completed. Student members recruited. Learning contexts selected and partner working groups formed
Research & Development Phase: May 09 to Nov 09	• Stakeholder discussions and forums conducted, video/audio recorded and selectively transcribed • Three Forums: Forum 1, May**.** Invited papers, 'Beyond the comfort zone' student-staff activities, panel discussions. Forum 2, July**.** To include focus groups/ trialling activities generated by Forum 1. Forum 3, October. To include working groups, focus groups and activities generated by previous forums • Interim project report delivered with a Literature review, Case study compendium, References & Guide scoping document • Reflective exercises during the forums feed into formative and summative evaluation
Analysis & Dissemination Phase: Nov 09 to 30 Apr 2010	• Analysis: Research data compiled and analysed qualitatively. Case studies compiled into a compendium and cross case analysis completed • Development and trial of the Implementation Guide: An Implementation Guide comprising the case studies, prototypes and design principles produced. Guide evaluated by the reference group and external evaluator. Guides containing activities trialled at partner unis (and later at cascade phase of project – for example with CDU, VU, UTS). Revision of guides • Summative Evaluation: Evaluator completes summative evaluation and produces an Evaluation Report • Final Project Report delivered with Guide including design principles, prototype designs, papers. The major dissemination will occur after the completion of the initial project to publicise the project to the sector and related industries and the general public via conference attendance, consultations by invitation, publications and a select media campaign targeting key education, architecture/design and consumer technology outlets.

Due to unforeseen circumstances arising from the replacement of the project manager mid way through the project and illness with the research assistant at a critical stage towards the end of the project the timeframe **for completion was extended to January 2010.**

4. Project Evaluation

The project evaluation has had both formative and summative elements which were guided by principles of action research and appreciative inquiry.

This is third of three evaluations for the Spaces for Knowledge Generation Project. The first two evaluations were formative with the purpose of guiding the project team toward more efficient and effective practice and to identify issues and practices that will be of interest to others undertaking similar projects. They also served to acknowledge achievements to date and to provide an element of risk assessment.

The first formative evaluation was undertaken by Professor Phil Long and Dr Steve Ehrmann as a reflective exercise at the conclusion of the first Reference Group Meeting. Upon reviewing progress, the project team decided to implement a further formative aspect to its external evaluation to enhance the overall evaluation in line with ALTC Guidelines (Chesterton & Cummings, 2010). Using principles of action research and appreciative inquiry, the evaluation aims to assure the project processes and guide others undertaking similar projects.

To this **end a second formative evaluation** was undertaken by Associate Professor Maree Gosper in March 2010. The approach taken to this evaluation was that of a 'critical friend' to facilitate reflection on the project outcomes, the pathway towards completion and project management processes.

A two day meeting of key members of the project team was held on 18 – 19 March 2010. In attendance were Associate Professor Kay Souter, Professor Mike Keppell, Mr Mathew Riddle, Dr Warren Sellers. The focus of this evaluation was to:

- identify what had been achieved - activities and developing principles and models;
- what still needed to be done; and
- how to proceed to completion – goals, activities timelines and responsibilities.

This was achieved and a report was submitted to the team on 18 April 2010. Overall, the conclusion was that the project was on track and should achieve very successful outcomes. There had been staffing difficulties and it was agreed that an extension of several months be requested from the ALTC to offset the lost time was a good idea and would make the final phase much more enjoyable for everyone. This extension was granted.

5. The Final Evaluation

The purpose of the final evaluation is report on:

- the overall effectiveness of project in achieving the stated outcomes;
- the effectiveness of the management and communication strategies in place to achieve the outputs;
- the critical success factors and challenges
- lessons learnt; and
- future directions

5.1 Evaluation methodology

Information was drawn from several sources:

i. Project documentation

The following sources of information were made available to provide insight into the project and its development to date.

- Final project report for the ALTC – December 2010
- ALTC – SKG Project Application
- ALTC six monthly progress report in April 2009 (Progress Report Template_June08.doc)
- ALTC year 1 report in October 2009 (Grants Scheme Year 1 Report PP8-849.doc)
- Formative Evaluation Report (Number 1) by Dr Steve Ehrmann
- Formative Evaluation Report (Number 1) by A/Prof Maree Gosper
- Documentation on SKG Project Wiki - http://wiki.skgproject.com/index
- Public Project web site: www.skgproject.com

ii. The project team

Team members were asked to provide comments on the following aspects of the project through written comments or a phone interview.

Outcomes

- the extent to which the intended outcomes have been achieved;
- any unintended outcomes;
- the effectiveness of dissemination activities to date; and
- the potential of dissemination plans to enable more effective capacity building across the sector.

Process

- variations from the activities and timelines that were initially proposed;
- evidence of flexible planning strategies during the project to accommodate issues as they emerged;
- adequacy of project resources;
- the effectiveness of communication and collaboration between the two universities and outside partners; and
- the role of the reference group and the effectiveness of their contribution.

Overall

- the critical success factors in managing the project and achieving stated outcomes;
- the factors that challenged or hindered the project process and outcomes; and
- lessons learned from this project and how these might be of assistance to other institutions.

iii. The reference group

Of the seven reference group members listed, one had no formal contact with the project and one had retired. Five were contacted and one replied to questions about:

- the potential of the project and its outcome to enable more effective capacity building across the sector;
- the critical success factors or those impeding success; and
- the factors assisted or hindered your contribution to the project.

It should be noted that feedback from the Reference Group was also obtained in the first of the formative evaluations and this was used to guide the development of the project.

iv. A selection of stakeholder

Stakeholders are individuals who have had some connection with the project and its outcomes through workshops, seminars or planning activities taken at their institutions. Nine people were contacted and six replied to questions about:

- the activities they were involved in;
- how the Project activities or outcomes have influenced their work; and
- the potential of the project and its outcomes to enable more effective capacity building across the sector.

6. Findings

6.1 Effectiveness of project in achieving the stated outcomes

The Spaces for Knowledge Generation project set out to promote strategic cultural change to university teaching practices and physical changes to campuses to advance learning and teaching. The Project has produced an impressive set of well researched set of resources that reflect teaching and learning as an evolving multidimensional process influenced by the personal, environmental, technical, physical and virtual elements of the space in which this takes place. These resources are publicly available through the Project Report (when it is released by the ALTC) and the accompanying Project website which acts as an ongoing resource with the potential for further extension. Included are:

- A set of seven principles of learning space design
- A sex step guide to the production of future-proofed spaces for knowledge generation
- An edited volume *Physical and Virtual Learning Spaces in Higher Education: Concepts for the Modern Learning Environment* to be published by IGI Global in 2011 which is an unexpected outcome that was not factored into the original proposal
- An animated set of design prototypes
- Examples of refurbished spaces
- Video interviews and presentations
- A full account of project activities.

Achievements against the stated outcomes are set out below:

i. A sustainable institutional model for designing leading edge learning spaces

The model is presented in the form of the ***Seven Principles of Learning Space Design*** which have been developed from the project activities (e.g. study tour, workshops, forums, literature review). The principles were used in the development of prototypes by Kneeler Design Architects and also in the refurbishment of spaces at La Trobe as part of the project. Their potential for wider application is noted by one of the stakeholders from La Trobe:

> *The project has considered a wide range of inputs as recorded on its web site at www.skgproject.com to identify key design principles for learning spaces as described at the "Toolkit" page. These are supported by the considerable amount of materials on the site in video and other formats that can be consulted by persons seeking to inform themselves about learning space design. These principles provide a solid basis for future innovation in learning space design. ……..As the SKG project progressed, the library refurbishment designs were reviewed by me against key findings. The library refurbished spaces were opened progressively from July to September 2010 and are heavily used by our students. (A member of the Library Refurbishment Team, La Trobe)*

ii. A practical guide including principles for institutions to design forward looking, adaptable learning spaces

A practical guide, *Six steps for the Production of Future-proofed Spaces for Knowledge Generation,* integrating the Seven Principles has been developed, based on the experiences of the team and stakeholders in refurbishing learning spaces.

iii. Increased awareness of student needs and perceptions in relation to university learning space provision and increased student input improved learning space provision

In developing the project, students formed part of the extended reference group participating in the learning space forums. The literature review has explored the space the perspective of the learner and has identified the core questions for the SKG project as firstly, what aspects of design and customizability students experience are important, and secondly, how to design and future-proof such spaces and link them into institutional learning activities (Project Report , P. 4). At the heart of the ensuing seven principles is a learner perspective rather than the more traditional teaching/institutional focus.

iv. Improved learning space provision

The Principles and Guidelines provide a valuable set of resources for universities to use to improve learning spaces. Illustrating the principles in action are examples drawn from the study tour, and design prototypes developed by Kneeler Designs.

The two spaces refurbished at La Trobe, as part of the project (the Faculty of Law and Management collaborative teaching and learning space and the Faculty of Humanities and Social Sciences Learning Room) serve as a working examples of how the principles can be used to retrofit existing spaces.

Overall, the methodology used in developing the project has served to raised the profile of the Project as well as the issues for considerations in developing learning spaces. The findings from the formative evaluations as well as comments from the project team reinforced the importance of these workshops as both developmental and dissemination forums.

Throughout the project 10 presentations were given at University forums and it is noteworthy that nine of these were invited presentations indicating first of all, the strength of interest in exploring issues relating to learning spaces across the sector and second, an awareness of the work taking place with this project. Stakeholder comments indicate the value of the work that has been undertaken and its potential for wider impact:

> *I can say that the forum made an impact on ideas about how we think about designing learning spaces at MQ.*
> *I should say that Mike's work raised awareness about the design of learning spaces but more significantly raised questions about how space is connected to students' learning through inter-subjectivity in that we are not isolated individuals but connected to the spaces/places we occupy. This makes the impact of Mike's work theoretical as well as practical. (Macquarie University participant)*
>
> *The forum contributed to the development of ideas around learning spaces, both physical and virtual. The presenter (Mike Keppell) brought another perspective to the ongoing dialogue at the university about how we best create enriched learning environments for students, wherever these spaces are. (Charles Darwin participant)*

v. Increased adoption of teaching practices to support student directed learning and knowledge production

Interwoven into the literature review, the podcasts, the descriptions of the refurbishments and the prototype designs is the underpinning theme of change – not only in relation to the spaces but the implications the spaces and the fixtures have for the teaching and hence learning. The full impact of the changes to teaching practice is not something that can be ascertained in the short term. Nevertheless feedback from stakeholders identified the potential of the project to promote changes to practice existing practices:

> *For the sector and my university in particular, in our objectives to modernise and re-purpose "space" to suit more collaborative methods of learning, this Project will assist communication between students, staff, designers and contractors to formulate best practice outcomes. The Project will inform targeted briefing across the broad spectrum of functional, aesthetic, social and economic parameters for attaining optimal learning environments. (A member of Facilities management Team at La Trobe)*

> *Research done within this project and documentation resulting from the research would enable key decision to be made within CSU based on solid evidence gained by ALTC. It would enable CSU to make decisions regarding technology procurement without going through the process of evaluating again, based on evaluation already performed. It would enable CSU to follow best practice pedagogy based on research already performed, without the need to go through the process again. (A Member of the CSU Committee for T&L Space Technologies)*

6.2 Management and communication strategies

The initial project team consisted of Associate Professor Kay Souter, Matthew Riddle and Stephen Jones as project manager (all of La Trobe University), Professor Mike Keppell of Charles Sturt University, Robert Bienvenu of Kneeler Design Architects, and Chris Feil of Apple Inc. Others joined the team later on, namely: Ross Ramus from Kneeler Design Architects, Dr Warren Sellers taking over as project manager and Natalie Pirotta as research assistant.

There were major issues related to illness within the project team that emerged which caused problems that effectively froze the project for some months, and there were various difficulties with budget matters that were associated with this. This resulted in a change in project manager close to mid-way through the project and an extension of the original timeline. Towards the end of the project the Research Assistant had unexpected neurosurgery but was very keen to continue with her work. This necessitated a further variation of about a month, unfortunately right at the end of our work

The ALTC is to be commended for being flexible in accommodating these problems which were beyond the control of the project team.

Despite these difficulties the project team maintained their focus and continued on to produce positive outcomes. Several factors were noted by the team as being important for dealing with the unexpected events and to maintaining their focus:

- a belief in the project and its aims;

- team members that worked well together and were able to accommodate different perspectives;
- a clear idea of how they could contribute and make an impact;
- a willingness to collaborate; and
- good team communication - this was aided by regular meetings or email communication as well as two team retreats where ideas were consolidated, goals were set, progress monitored and responsibilities identified. Communication in the form of telephone/video/Skype conferencing proved highly effective in regular real-time communication. The use of a Wiki was expeditious for regular asynchronous communication and documenting. The two project forums and the study tour also set the team up for easy communication.

Another factor that contributed to the success of the project was the work of the Reference Group. As well as the nominated key group identified at the outset of the project, this was extended to include students, academic and administrative staff from across the sector - both national and international.

Project resourcing can be an issue as budgets developed in advance can only be notional. In this project the Project Team agreed that the resourcing was adequate and the project came in under budget. With the unforeseen circumstances that arose it was important that there was flexibility in changing the mix of funding for the different project activities to accommodate changing needs.

One of the team members noted that it is not realistic to expect the ALTC to fund all activities as the host Institutions and external partners gain from the research and development work being undertaken, hence they could be expected to make a contribution. If funds are handled well it can be a win-win situation for all concerned.

A positive feature of this project has been collaboration with industry partners - Apple Consortium and Kneeler Designs.

Apple had a supporting rather than developmental role in the project. They have a strong commitment to education however their participation was limited by the need to balance contributions across all universities. Nevertheless they were able to advise on the study tour and through the Apple Universities Consortium were able to provide support funds for the tour. In addition they sponsored an event at Mac World and provided technical expertise and advice to the project team. This in turn enabled them to maintain their profile in the sector and disseminate information about their latest advancements.

Kneeler Designs have worked closely with the school education sector and welcomed the opportunity to work with and learn from the higher education sector. They bought to the project their expertise in studio design -studio designed teaching is recognised as a creative and collaborative form of learning. They were able to bring a fresh perspective and extend the thinking of the team to encompass more contemporary design principles and this is reflected in the three prototype designs developed as part of the project outputs.

Of particular value to Kneeler were the insights they gained from students. Emerging from this collaboration has been a recommendation by Kneeler designs to incorporate a question on the design of educational spaces in the national design exam which is part of the Architects Accreditation Program.

6.3 Critical success factors and challenges

Overall, the key factors identified by the project that contributed to the success of the project were:

- good support from project management and research assistants;
- aligned perspectives on the importance of space for effective teaching and learning and also on the understandings of the design principles that evolved;
- commitment of the team in challenging circumstances and the ability to keep going after setbacks; and
- good communication between members of the project team.

Some of the challenges that were identified which may have implication for similar large scale, sector wide, teaching and learning projects were as follows.

Changing institutional priorities emerging throughout the project. In this case, La Trobe undertook (and is now in the middle of) an enormous curriculum renewal project which impacted massively on the time the La Trobe people. Fortunately there was flexibility within the budget to reallocate funds and resources to meet these demands.

The zero status of ALTC grants in terms of the ERA process. This is not always clear to academic new to ALTC grants. Balancing research and teaching development becomes difficult, particularly for academics who have ALTC grants but are not members of Academic Development Units or similar.

Unclear University processes for managing ALTC process, a result perhaps of the relative novelty of the Grants compared to ARC grants.

Attracting and keeping good project managers who understand and can work within the academic context.

6.4 Lessons learnt from the project

Each learning and teaching development project has its own character formed by the project goals, the methodology adopted and the culture of contributing Institutions along with the particular talents of team members. This project has faced a number of challenges that were overcome largely through the commitment of the Project Team and also the flexibility provided by the ALTC in regard to timelines and allocation of resources. Faced with this particular context the team members offered the following observations on some of the key lessons they have taken away from the experience that might be of value to fellow travellers.

The need to build in awareness at the outset of possible changes to the institution or team and the possibility of disruption by major illness is vital. This was not initially considered and it took a while to sort out and this was aided by the teleconference organized by the ALTC about project setbacks.

It is important for partners to own a part of the project. Although the project was collaborative in nature having a component that you can claim ownership over and develop collaboratively with other team members helps with maintaining focus and commitment over an extended

period of time. There has to be an element in the project for each of the partners and negotiating this at the outset is important so that the project can progress easily.

Valuing the importance of a culture of learning is important as it can promote openness to new ideas and a willingness to share ideas and experiences.

Securing the right project manager is critical for ensuring timelines are kept and milestones met, resources are allocated appropriately, communication channels are established and processes and outcomes are documented to form a transparent audit trail. The Project Manager's role and indeed that of other team members needs to be clearly defined so that any differences in expectations can be resolved from the outset.

Project management expertise and effective institutional systems continue to be a scarce resource in the Higher Education research sector. One of the team members was pleased to report that as a consequence of this project, institutional systems are being improved to better support project financial management in particular.

7. Concluding Comments

Overall despite the setbacks encountered along the way, the Team is to be congratulated on a very successful project. The Project has raised awareness of the intersection between teaching and learning and the spaces in which these activities take place. It has achieved both important theoretical and practical outcomes in the form of principles, guidelines and prototypes and models of spaces for knowledge generation.

The Project has been well regarded by all stakeholders with feedback indicating the potential for ongoing impact across the sector and provides strong foundations for future explorations. There was also strong appreciation of the role of the ALTC in promoting good practice in the sector.

> *The ALTC is seen as a key body determining best practices and best design principles in the sector and as such, outcomes from the project would assist guide and steer design principles for CSU in the T&L spaces. (A Member of the CSU Committee for T&L Space Technologies)*

The ALTC has a pivotal role to play in building on the existing platform of work and supporting further dissemination of outcomes as well as new research and development initiatives. One area for potential research identified by Kneeler Designs is around studio-based learning and how studio spaces can be integrated within larger traditional teaching spaces.

Another is in extending the current findings to a range of environmental contexts and to other sectors.

> *The Learning Spaces Project can provide models on which the sector can build. Each learning environment is different and in terms of physical spaces, a model that works well for a large university in a colder climates will not necessarily work well in a*

small, tropical regional university. The concepts will need to be adapted to take account of the context. Similarly, while many virtual learning spaces can be reasonably universal, the nature of the student cohort, and local conditions influence the use of that space. So the more models that The Project can provide, the better. This should include HE and VET sector models, as there are a number of dual sector universities in Australia which need to cater for varied patterns of student engagement. (A participant from Charles Darwin invited presentation)

Finally, the outputs of the project are presented in web-based format designed as an on-going, updateable resource. To keep the notion of spaces for knowledge generation alive, the project team can see benefit in taking the project on the road to discuss the Seven Principles. This is highly desirable if the ALTC is to further develop capacity across the sector.

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