



**THE UNIVERSITY
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AUSTRALIA



**Designing Next Generation Places of Learning: Collaboration
at the Pedagogy-Space-Technology Nexus**

ALTC Priority Project #627

The University of Queensland

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Executive Summary

There is growing interest in higher education institutions, nationally and internationally, in the creation of new types of learning environments supporting learner-centred or constructivist pedagogy. While many new facilities start out with sound pedagogical intent, the actual spaces often reflect the imperatives of technology, or architecture, or operational considerations. A more systemic way to maintain the appropriate balance between pedagogy, space and technology as a basis for the design and evaluation of new learning spaces is needed.

The Next Generation Learning Spaces (NGLS) project explored the interdependence of pedagogy, space and technology to develop the Pedagogy-Space-Technology (PST) framework which enables institutions to create new teaching and learning spaces that will encourage student engagement and improve learning outcomes.

The PST framework is a question-driven inquiry process synthesized from published literature and knowledge of innovative teaching and learning spaces globally, and informed by lessons learned in developing new learning facilities at The University of Queensland (UQ) over the past decade. It empowers a diverse range of potential stakeholders to consider critically and holistically the pedagogical, technological, and physical aspects of teaching and learning spaces and their interactions. It can be used at each stage of the life cycle of a new facility, from conception through stages of design, construction, and operation.

Focus	Life-Cycle Stage	
	Conception and Design	Implementation and Operation
Overall	<i>What is the motivation for the initiative?</i>	<i>What does success look like?</i>
Pedagogy	<i>What type(s) of learning and teaching are we trying to foster? Why?</i>	<i>What type(s) of learning and teaching are observed to take place? What is the evidence?</i>
Space (including environs; furniture and fittings)	<i>What aspects of the design of the space and provisioning of furniture and fittings will foster these modes of learning (and teaching)? How?</i>	<i>Which aspects of the space design and equipment worked and which did not? Why?</i>
Technology (ICT; lab and specialist equipment)	<i>How will technology be deployed to complement the space design in fostering the desired learning and teaching patterns?</i>	<i>What technologies were most effective at enhancing learning and teaching? Why?</i>

The table illustrates the basic questions for the various stages of a new facility. Each of these basic questions is expanded into a more detailed set of questions and issues to be considered and guide the process. As an evaluation tool, it links design intent with outcomes, and challenges all concerned to question the what, why and how of initiatives to create new learning spaces. Its generic simplicity means it can be used for any type of learning spaces from a laboratory to a learning commons, to more conventional performance space. The framework can also be applied to small or large scale projects. It is inherently self-documenting and aides the elicitation of lessons learned for future projects. Within UQ, the framework was used to refine various learning spaces such as the new Collaborative Teaching and Learning Centre (CTLC), the Advanced Concept Teaching Space (ACTS), and a next generation library in the Biological Sciences Library.

The project team has held two national Colloquia which have helped to educate and develop a diverse, interdisciplinary community in the higher education sector focussed on new learning spaces.

Subsequent to the Colloquia, several institutions have revised their approach to learning spaces. It is anticipated that the PST framework, and the shared experience of new learning spaces gained as a result of the project, will continue to influence the creation and evaluation of innovative learning environments in higher education in Australia and beyond.

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Outcomes of the Project

The primary goals were to develop, test, evaluate and disseminate widely a new framework for approaching the design and evaluation of new learning spaces. The attainment of these interlinked goals is outlined in the following sections.

Pedagogy-Space-Technology (PST) Framework

The major transferable outcome of the project is the new design framework based on the pedagogy-space-technology nexus. It was developed through a collaborative and participatory process, and incorporated knowledge from the stakeholders involved with learning spaces.

The PST framework is essentially a series of questions designed to identify key requirements for a new learning space in terms of pedagogy, technology, and physical space and inform the design process (Table 1). The PST framework can also be applied to existing spaces as a means of evaluating performance. In using the framework to either design or evaluate, each of the fundamental questions illustrated in Table 1 is expanded into a more detailed set of questions and issues to be considered, that guide the process.

Table 1- Pedagogy-Space-Technology (PST) Framework

Focus	Life-Cycle Stage	
	Conception and Design	Implementation and Operation
Overall	<i>What is the motivation for the initiative?</i>	<i>What does success look like?</i>
Pedagogy	<i>What type(s) of learning and teaching are we trying to foster? Why?</i>	<i>What type(s) of learning and teaching are observed to take place? What is the evidence?</i>
Space (including environs; furniture and fittings)	<i>What aspects of the design of the space and provisioning of furniture and fittings will foster these modes of learning (and teaching)? How?</i>	<i>Which aspects of the space design and equipment worked and which did not? Why?</i>
Technology (ICT; lab and specialist equipment)	<i>How will technology be deployed to complement the space design in fostering the desired learning and teaching patterns?</i>	<i>What technologies were most effective at enhancing learning and teaching? Why?</i>

The sequencing of the items in the framework – pedagogy-space-technology - is intentional and important. Each of the three elements, pedagogy, space and technology, influence each other. The arrangement of the shape and use of a space will influence the desired pedagogy. A learning space irrespective of its intended use will tend to shape what people do in it and hence the patterns of teaching and learning. Similarly a particular space places constraints (or presents opportunities) for the introduction of certain types of technology while a given technology can impact how a space is used by teachers and students. Thus while all three are interdependent in a cyclical manner, the question remains with which element do you start? Pedagogy seems to be the logical element to consider first, then space and finally technology.

However this is not to suggest a hierarchy or to value pedagogy over space or technology. Rather it is a recommended place to enter the pedagogy-space-technology loop in order to go through an iterative process. Ideally such iteration would occur several times at each stage of the life-cycle of a learning space (cradle to cradle). While only two life-cycle stages are represented in the Table 1 (as the columns - Conception & Design and Implementation & Operation), the framework could be made more fine-grained by splitting these into more than two columns corresponding to more life-cycle stages and writing appropriate questions to each stage. Thus if a particular institution has a

prescribed set of project stages with decision points (stage gates), then the basic PST framework questions can be re-written to suit the delivery steps or stages for the institution; it can be tailored to meet particular ways of doing work.

The PST framework makes explicit the contention that evaluation should be focused on measuring the degree to which the original goals, particularly the defined pedagogic goals, were met. While in no way denying that the goal of improving learning outcomes should be paramount, the PST takes a step back from trying to evaluate this directly. The goals of the space are defined in terms of fostering particular modes or patterns of teaching and learning. The primary evaluation therefore, is to determine whether or not such behaviours are observed and which aspects of the space and technology are seen to enable, encourage and empower these types of teaching and learning activities.

The framework can be applied to address the continuum of places where people learn: formal and informal; teacher directed and learner directed; physical and virtual; on campus and off campus; and takes account of the three dimension (PST) in informing the conceptual design and post-occupancy evaluation of either discrete learning environments (e.g. individual rooms) or networks of places (e.g. a whole campus). The format of the PST framework allows the concepts to be generalised and replicated in new and different applications around the country, and beyond.

The NGLS project contributed to the design, demonstration and evaluation of three distinct types of learning environment through use of the unified approach of the PST framework. Details of these three environments, which are: collaborative learning centres; the Advanced Concept Teaching Space (ACTS); and next generation libraries are provided below.

Collaborative Teaching and Learning Centre spaces (CTLC)

The Collaborative Teaching and Learning Centre spaces were designed to foster collaborative approaches to teaching and learning, both internally in the small and large collaborative teaching and learning spaces and externally through the videoconferencing and access grid rooms. Critically, the design of these spaces was seen as offering teaching and learning opportunities not provided by traditional teaching and learning spaces. The CTLC spaces support timetabled teaching activities as well as independent study for students. In the period from 2005 to 2008 The University of Queensland opened three such spaces, and in each a serious attempt was made to evaluate the strengths and weaknesses and to improve the succeeding generations of CTLC.

The project team sought to understand how successful these spaces are in achieving the anticipated outcomes particularly those related to fostering collaborative teaching and learning activities for both staff and students. Consequently an extensive evaluation of CTLC spaces has been conducted since 2006 and is ongoing. The team has used the opportunities provided by this unique multi-generational project to attempt to better define the relationship between pedagogy, space and technology. In the process we have investigated a number of factors including staff and student usage, the reasons students use the centre, the technology they find most useful, the design aspects of the space and how this impacts on learning, how staff use the centre, and the impact of staff development activities.

The Advanced Concept Teaching Space (ACTS)

Increasingly, students are using a variety of new technologies in their lifestyles and learning. The second 'new-style' space which was informed by the NGLS project is the Advanced Concept Teaching Space at the University of Queensland. ACTS as a 'state of the art' teaching and learning space plays a key role in enabling research into new pedagogies, teaching technologies, and teaching space design. It explores ways to integrate this using wired and wireless networking and direct USB connection. ACTS is a laboratory for teaching technology and is capable of rigorously evaluating

each proposed practice. It allows the best emerging technology to be tested and adopted into mainstream UQ teaching spaces.

As research into teaching methods and technology is the prime function of ACTS, a spacious observation room was included. Wide windows and access to video cameras allow researchers to carefully monitor how students use the various technologies available. In addition, the observation room has a duplicate computer and control system to allow an operator to assist with complex presentations. The features and technologies in ACTS aim to open new channels of communication and to permit new kinds of interactions to occur during class sessions. While the design and development of the space informed the team's work, ACTS was not completed in time for the NGLS project to study it in operation.

Informal Learning Spaces

The informal learning spaces at The University of Queensland are designed to cater to the technological and space needs of students without an overtly traditional design. Many informal learning spaces appear similar to the common or 'home' rooms in university colleges. They have comfortable seating, smaller tables, limited basic kitchen amenities and a relaxed, unstructured atmosphere. It is in these informal learning spaces that students choose to gather and work collaboratively. Students identify these spaces as their own and use them for learning and recreational activities. The provision of informal learning spaces on campus has increased the amount of time that students spend on campus as well as their informal interaction with academic staff.

By creating such spaces specifically for first year cohorts, the students are given a location that 'belongs' to them and reduces the social trauma of moving from a smaller secondary cohort into the much larger, more diverse university student community. The positive responses to the creation of informal learning spaces at the University of Queensland, such as the Engineering Learning Centre, has led to much increased demand for similar spaces in nearly all faculties and schools. The improved student-academic interaction and the development of a learning community have far-reaching positive outcomes for the University.

Biological Sciences Library

The role of the library in higher education has undergone a series of substantial evolutionary steps over the past few decades (Table 2). The culmination of this process is the fourth generation library. Fourth generation libraries offer diverse learning experiences where printed and digital information can be combined in an environment which is user focused and service rich, where students can work collaboratively in spaces that support current social and learning patterns. They are places where librarians can communicate the outcomes of student learning processes. Critically, this latest generation of library acknowledges that learning behaviour is the driver for change and creates a situation where technology is one of its support tools. The Biological Sciences Library is an example of a fourth generation library at the University of Queensland. This library space builds on ideas that have evolved and been tested over the past ten to fifteen years.

Table 2 – Evolution of the Library

Generation	Defining Characteristics
1 st	<i>Collection centric</i> book stacks; banks of computers; study cubicles
2 nd	<i>Client centric</i> service focus; helping users to locate and access information
3 rd	<i>Experience centric</i> seeking educational impact; a choice of study experiences to enable engagement with information; interaction with information of all types – printed, digital, moving media and significantly other people
4 th	<i>Connected Learning Experiences</i> creating spaces based on pedagogy at a whole of school or campus level as a learning environment; distinctions between libraries and other spaces on campus become blurred; boundaries become permeable

The Biological Sciences Library recently underwent a \$13.5m refurbishment designed by Wilson Architects and now includes an additional 800 m² of space to accommodate the growing collection and new postgraduate study spaces. These spaces include discussion rooms complete with data-projectors and plasma screens, three training rooms, more than 200 computers, a graduate study centre, AV booths, as well as a mix of individual group study spaces. All of these additions cater for diverse learning experiences where printed and digital information is combined in an entirely user-focused environment.

Colloquia

The higher education sector in Australia has recognised that the physical learning environment has a significant impact upon learning and the student university experience. Although academic excellence has long been seen as the drawcard for universities, the focus is now shifting to include the physical elements on offer, and new learning spaces are a major factor in attracting and retaining student interest.

The Inaugural NGLS Colloquium in July 2007 was intended as a forum for the gathering and sharing of knowledge on the development and use of new learning spaces in higher education institutions in Australia. It attracted 131 participants from universities around Australia including academic staff involved in new learning space initiatives, librarians, senior administrators, technology managers, facilities managers and architects. Many of the 46 institutions represented at the Colloquium, including Go8 and private universities, were in the process of planning new learning spaces, while others had already done so and were reporting on the ways in which they were used. Delegates networked, heard presentations from leading learning space innovators from the USA and Australia, they experienced the use of a variety of new learning spaces including the Collaborative Teaching and Learning Centre, the new First Year Engineering Learning Centre, and the Biological Sciences Library. Several adaptations in delegates' approach to next generation learning spaces in higher education institutions were initiated following the Colloquium. Delegates reported that the considerations of pedagogy and evaluation in the planning of new learning spaces were of equally high importance. Collaboration with all stakeholders in the development of new spaces was considered only slightly less important, and the flexibility of the learning space was given only minimal consideration after all other aspects. In addition to including various sector representatives

in planning committees, students were also consulted to provide a broader view of what would be required of new learning spaces from the next generation of learners.

The second Colloquium held in October 2008 brought together 125 delegates and focused on the evaluation of new learning spaces in higher education institutions. Members of this growing national community of practice in new learning space presented case studies of initiatives at a variety of institutions from around the country. These cases were each written up and presented using the questions-based PST framework as an adaptation of the approach used by Educause in the USA to do comparative cases of learning spaces. Various approaches to evaluation and assessment of learning spaces were demonstrated through case studies that used the PST design framework for evaluation. This single yet flexible analytical lens facilitated conversations, as all had a common basis. The delegates at the second Colloquium were also the first people to experience the just completed Advanced Concept Teaching Space (ACTS).

As a direct outcome of the information disseminated at the Colloquium, several institutions revised their approach to learning spaces on the basis of the overview of case study presentations, which gave them more understanding of the challenges arising and potential solutions. Reports on both of the Colloquia are attached (Appendices 4 and 5).

Approach and Methodology

The NGLS Project was very much a community building exercise and has succeeded beyond expectation in both establishing a dialogue throughout the tertiary sector and in setting the agenda for discussion relating to the design, building and evaluation of teaching and learning spaces.

The methodology can be divided into three phases:

- Develop the pedagogy-space-technology (PST) framework;
- Explain, illustrate and disseminate the PST framework for testing; and
- Test, evaluate and disseminate the PST framework through case studies.

Develop the PST Framework

For pragmatic reasons, the design of teaching and learning spaces in higher education institutions is often understood in terms of the need to fit as many individuals as possible into a cost-effective space designed for the delivery of information. The pedagogy has traditionally been in the form of one-to-many and styled as a lecture. Although cost per m² is minimal for this style of space, the learning outcomes can be extremely limited and it is also likely to contribute to student attrition. The design of a lecture theatre, in terms of seating and technology, limits the pedagogical style to one-to-many delivery. The restrictions this entails reduce the opportunity for students to interact with information, each other, and teachers. Research has demonstrated that the best learning outcomes are generated through a constructivist pedagogical approach (Brown, 2005; Ehrmann, 1995; Valiant, 1996).

Examples of this approach include active learning, collaborative and group work, experimentation, and role playing. The constructivist learning theory is based on the ability of an individual to assimilate new knowledge into their own unique understanding through activity. Traditional learning spaces in higher education institutions do not usually provide the type of spaces that will enable such learning. The positive response of students and teachers to new learning spaces has

been a strong indication that these new learning spaces are one answer to meeting the learning styles of the new generation of students.

There is no generally agreed to approach for the creation of teaching spaces that effectively support constructivist learning. A number of authors have proposed either lists of design principles or sets of critical characteristics that contemporary learning spaces should exhibit. Some of these lists of principles are aspirational while others imply they are based on experience. However there is really very little objective data based on well documented case studies or analysis that can be used to test these.

The Designing Spaces for Effective Learning report (JISC, 2006) argues that “a learning space should be able to motivate learners and promote learning as an activity, support collaborative as well as formal practice, provide a personalised and inclusive environment, and be flexible in the face of changing needs.” It states that the design of individual spaces within an educational building needs to be:

- Flexible – to accommodate current and evolving pedagogies;
- Future proofed – to enable space to be re-allocated and reconfigured;
- Bold – to look beyond tried and tested technologies and pedagogies;
- Creative – to energise and inspire learners and tutors;
- Supportive – to develop the potential of all learners; and
- Enterprising – to make each space capable of supporting different purposes.

Oblinger (2005) takes a more focused and learner centred approach to the design of facilities:

- Design learning spaces around people;
- Support multiple types of learning activities;
- Enable connections, inside and outside;
- Accommodate information technology;
- Design for comfort, safety and functionality; and
- Reflect institutional values.

Jamieson *et al.* (2000) promote the adoption of multi-disciplinary approaches and the use of participatory design processes and offer the seven guiding principles to be used for “augmenting rather than replacing *in toto* existing design principles” as follows:

- Design space for multiple use concurrently and consecutively;
- Design to maximise the inherent flexibility within each space;
- Design to make use of the vertical dimension of facilities;
- Design to integrate previously discrete campus functions;
- Design features and functions to maximise teacher and student control;
- Design to maximise alignment of different curricula activities; and
- Design to maximise student access to and use/ownership of the learning environment.

Denison University, a small liberal arts college in Ohio, established the Learning Spaces Project to “enhance the utility, appearance and comfort of all campus spaces related to learning. Learning spaces must support many styles of learning, be versatile, comfortable and attractive, rich with information and reliable technology, maintained and accessible” (Siddall, 2006). They present the following set of design guidelines:

- Learning spaces should support a diversity of learning styles;
- Learning spaces must be versatile;
- Learning spaces must be comfortable and attractive;
- Learning spaces are information rich and technologically reliable;

- Learning spaces must be maintained continuously;
- Learning spaces should be ubiquitous in space and time;
- Learning spaces should be used effectively; and
- Sufficient resources must be allocated for learning spaces.

Johnson and Lomas (2005) point to a series of steps that combine “to create an iterative dialogue among the design team and other stakeholders in the design process.” The process suggested is organic and begins by considering the institutional context (Its values, strengths and limitations) and the learning principles that are to be promoted. These reflect concepts in classic works like Chickering and Gamson’s “Seven Principles” (1987) or the more recent and popular NRC report on “How People Learn” (Bransford *et al.* 2000).

The team works from the desired learning principles to define a set of learning activities that will promote these principles. The design principles flow from learning principles and the learning activities. Thus there is not a single universal set of design principles but a particular set that meet the needs of a given project. It is only after the design principles are established that the requirements for the particular setting are derived. Johnson and Lomas go on to emphasise the importance of considering how to measure success in the design of new learning environments.

Taking yet another tack, Long and Ehrmann (2005) suggest four ideas that are useful in imagining the classroom of the future:

- Learning by doing matters;
- Context matters;
- Interaction matters; and
- Location of learning matters.

They proceed to list the characteristics of the “classroom of the future” as:

- Designed for people, not for ephemeral technologies;
- Optimised for certain learning activities, not just stuffed with technology;
- Enabling technologies *brought* into the space, rather than *built* into the space;
- Allowing invisible technology and flexible use;
- Emphasising soft spaces;
- Useful across the 24 hour day; and
- Zoned for sound and activity.

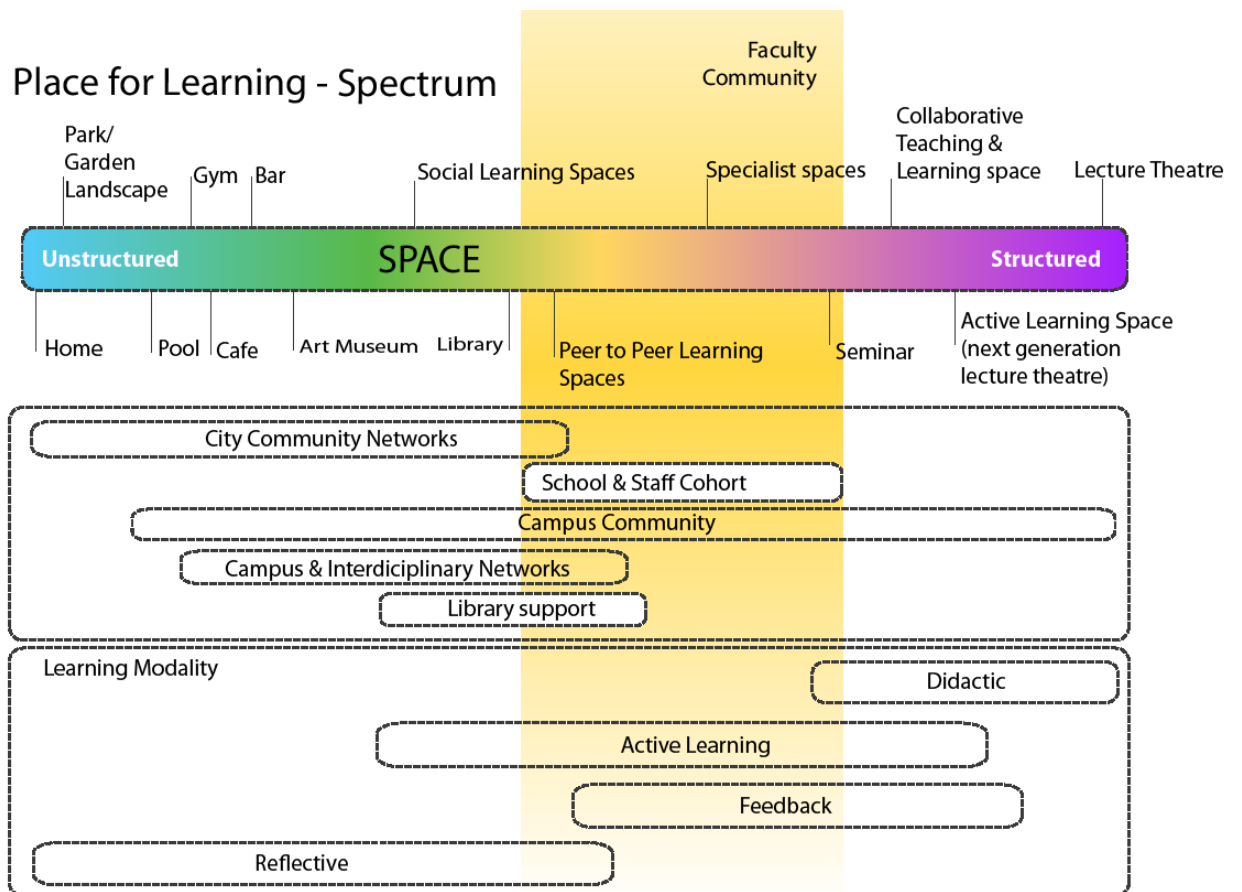
It is clear that there is no single agreed approach to developing sets of design principles for new learning spaces, nor is there a universal set of principles. The NGLS team approached this situation with the objective of providing both a framework for gathering evidence to support the design of new learning spaces and for the evaluation of learning spaces based on the pedagogy-space-technology nexus.

The work of the NGLS team is richer for the contribution of Professor Peter Jamieson (University of Melbourne), whose insights into the processes of design on the original Collaborative Teaching and Learning Centre (Sir James Foots Building, University of Queensland) were both perceptive and constructive; Keith Webster (University Librarian, University of Queensland) who provided invaluable collaborative communication into library design and evaluation; and Professor Phillip Long (formerly MIT, now UQ) whose international perspective informed and motivated discussion throughout each phase.

As part of the methodology in relation to the process of procuring new learning space, different structures were developed for different identified phases. To illustrate one of these structures, as

part of the 'Funding Bid', a *Place for Learning Spectrum* (Figure 1) was developed to explore the relationships between various spaces, people and learning modality. The 'Funding Bid' phase needs to consider all space bids and to do this effectively it should be evaluated with respect to the overall ecology of campus learning spaces. This model begins to look at an institution as a whole and at space as a highly connected network of places for learning rather than it being made up of a series of learning silos. The model below proposed that every square metre has the potential to support the learning process and so every coffee shop; every corridor; every courtyard is incorporated into the design.

Figure 1 – Place for Learning Spectrum



The PST framework provides common ground for engaging all the relevant stakeholders at the start of a project. Many groups have a stake in the success of new learning spaces including students, staff, senior administrators, technology managers, architects, builders and contractors, facilities and security managers, and time-tablers. In recognition that each of these stakeholder groups brings a particular set of background assumptions, expectations and practices about how they should or could contribute to the realization of a new learning space project, the framework is not in the form of a prescriptive model of the design or delivery process *per se*.

A model-based approach for such a framework would tend to privilege those who were familiar with that particular form of representation, depending on what type of model was used or how it was presented visually. For instance if the framework were constructed around a model of the design

and delivery process familiar to architects, this might not mean very much to a faculty member from, say, the liberal arts who is trying to evoke a particular learning experience, or an administrator who is focused on project management issues like cost and risk. By using a series of generic trigger questions all stakeholders potentially have equal access to the design conversation.

One reason for keeping the framework simple was to enable it to be used in a wide range of project types and scales and institutional contexts. An objective of the NGLS is to try to get comparative data from many different projects across the country, both current and completed, so that it is possible to identify patterns in what different institutions are trying to achieve, how they do this, and how they evaluate success. Obviously additional and more detailed questions can be added in each section and at each stage as fitting the particular instance.

This structure is just one of the mechanisms that can better develop a dialogue about the strategic delivery of new learning spaces.

The resulting ideas were expanded and tested for effectiveness through the research and development processes that were underway with respect to the three project areas in train at University of Queensland. These were the Collaborative Teaching and Learning Centres, the Library projects and the Advanced Concept Teaching Space. In particular, the research and evaluation work across the three generations of CTLC, undertaken in collaboration with Trish Andrews (Teaching and Educational Development Institute, UQ) was invaluable in refining the PST relationships.

Explain, Illustrate and Disseminate the PST Framework

The Inaugural Colloquium, held in July 2007, marked the midpoint of the project. It also represented the completion of the first phase of research and provided a substantial contribution to the second phase of the project.

The Colloquium directly reached key representatives from 46 institutions and the flow-on effects disseminated the framework to virtually all national tertiary education institutions. The PST framework was presented by speakers who brought national and international perspectives to its discussion. The experiential nature of the event demonstrated and emphasized the interdependence of pedagogy, space and technology for the delegates.

In addition to the Inaugural Colloquium, the project team presented the PST framework to national audiences of peers. Presentations in Sydney, Adelaide and Perth as part of the ALTC 'Places and Spaces for Learning' Seminar summarised the message to a broad audience, while two presentations at the Association of Educational Technology Managers (AETM) annual conference (2007) brought the work into focus for educational technology managers and directors.

Testing and Evaluating with Case Studies

The project tracked the process and outcomes of three generations of Collaborative Teaching and Learning Spaces at The University of Queensland. These were important and novel spaces, well suited to study, and of significant interest nationally. The research work carried out by the project investigators strongly indicated that the PST framework, has significant utility not just in the conception and design of teaching spaces but also in the crucial process of evaluation. In order to test the efficacy of the framework across a range of spaces and institutions, participants in the 2008 Colloquium were asked to produce case studies specifically using the framework.

A total of eighteen case studies were presented, each of which overtly used the PST framework to discuss and evaluate a wide range of teaching and learning spaces at tertiary education institutions.

These studies were peer reviewed by the project team and demonstrated a consistent application of the PST principles.

The papers presented at the Colloquium gave ample evidence that universities are seeking to experiment with different kinds of learning and teaching spaces. In many cases, the completion of a new kind of learning space prompts a plethora of “me too” requests within and across institutions. UQ is a case in point. Colloquium attendees in 2007 were able to examine the first faculty-based ‘Student Learning Centre’ at UQ (although many already existed at other institutions). By 2008, UQ had completed another two such spaces with a further four under construction or in planning. While these spaces had different planners, builders and user groups, they were essentially similar in concept and pedagogic intent. The pace of work and overlapping schedules has meant that new centres are being designed, specified and tendered before others are even occupied, leaving little or no opportunity for evaluation and consequently improvement of space design or technology provisioning. Clearly this is undesirable and the intention is that evaluation be undertaken in a timely way and that results might be shared across institutions to enable us to move forward and avoid repeating mistakes in new spaces.

The focus of the NGLS project across two years was to:

- Follow the development of succeeding generations of new-style teaching space; and
- Study longer term generational developments in library space.

These two foci yielded an interesting divergence in evaluation issues as well. Roughly half of the papers presented at the 2008 NGLS Colloquium represent library spaces. The papers that were not library based covered faculty learning spaces and “non-traditional” teaching spaces. Library spaces tend to be constantly evolving, although punctuated by major refurbishments from time to time. By and large, the papers amply demonstrated that libraries are both competent and experienced at self-evaluation.

In contrast, teaching space in general is poorly represented in terms of evaluative studies. It seems likely that traditional teaching spaces are seen to be well understood and hence not in need of research or evaluation. Many of the non-library examples in literature and all of the examples presented at the Colloquium are revolutionary spaces, new kinds of teaching and learning spaces which are seeking to push change in practice. The UQ Collaborative Teaching and Learning Centre, Victoria University Engineering Project Based Learning Space, and the Deakin Immersive Learning Environment are clear examples in this respect. While the library spaces focus more on finding out how users needs are changing and responding, the teaching space design and evaluation looks more intentional with a desire to shift behaviours.

It is instructive to review the aims of evaluation. There are a variety of motivators for undertaking evaluation. Some appraisals appear to have the goal of validating a newly completed project and by extension, arguing for the creation of similar spaces. Simpler measures such as head counts and multiple choice user satisfaction questions are often the mainstay of these surveys. By contrast, research projects or design studies aimed at informing ongoing development typically strive to uncover more detail, both by targeting empirical measures and probing with open ended questioning and focus groups. Several threads emerged in the 2008 Colloquium forum session addressing the desirability of evaluating spaces in terms of (improved) learning outcomes.

Learning outcomes are clearly dependant on a significant number of variables beyond the space and the task of evaluating a space with respect to these outcomes when so many other contributing factors typically remain uncontrolled is difficult indeed. While in no way denying that improving learning outcomes should be paramount, the PST Framework takes a step back from trying to

evaluate this directly. The goals of the space are defined in terms of fostering particular modes or patterns of teaching and learning. The primary evaluation therefore, is to determine whether or not such behaviours are observed and which aspects of the space and technology are seen to enable, encourage and empower these types of teaching and learning activities. The task of determining whether the pedagogy improves student learning outcomes is left to a wider, possibly whole of institution based evaluation.

The eighteen papers and accompanying presentations which used the PST framework and a consistent set of presentational guidelines provide a good indication of the utility of the framework and strong support for the project's own evaluation of space.

Papers drawn from the case studies presented at the Second Colloquium will be published in edited proceedings which will be available in early 2009. This publication will allow for the PST framework to be widely reviewed and assessed by planners, architects, builders, academics, and technologists.

Advancing Existing Knowledge

The Pedagogy-Space-Technology framework is a significant contribution to knowledge about the design and evaluation of teaching and learning spaces. It builds on and synthesizes three sources of prior knowledge.

- Published literature.
- Prior knowledge gained by the three co-investigators from direct observation or documentation of new and existing teaching and learning spaces in Europe, North America and Asia as well as across Australia and New Zealand.
- The specific experiences encompassed in the detailed review of the three kinds of projects ongoing at UQ and upon which the project was focused:
 - The first, second and third generation Collaborative Teaching and Learning Centres;
 - The new style libraries including the Ipswich Library and the Biological Sciences Library; and
 - The Advanced Concept Teaching Space (design and construction only).

With respect to the literature, the project identified a number of contemporary international landmarks that are widely known and discussed in Australia, and that could be used to assist in the definition of the PST framework. Of particular note is the Educause publication 'Learning Spaces' (Oblinger, D. 2006, www.educause.edu/learningspaces) which provided the platform for the NGLS team to develop the PST framework.

Implementation of Project Outcomes

The single most important factor to the success of the NGLS project was the multi-disciplinary project team. The team have overlapping interests and complementary expertise in the design of learning environments from the perspectives of pedagogy, space and technology. This provided a unique combined perspective of the requirements for new generation learning spaces and also informed the development of the PST design framework. The direct support for the project from the Senior Deputy Vice-Chancellor (Professor Michael Keniger) and the Deputy Vice-Chancellor (Teaching & Learning) (Professor Deborah Terry) were invaluable to the success of the Colloquia and the dissemination of the project outcomes. Support from the University Librarian and Director of Learning Services (Keith Webster) and the involvement of UQ Library staff in the assessment of learning spaces and active dissemination of findings, greatly increased awareness of the project locally and internationally.

As the learning spaces at The University of Queensland are so different, they provide a powerful study subject. Attention to these spaces has been greatly increased through the NGLS project and has allowed the project team to investigate and test various aspects of the PST design framework.

Delays in construction have impeded the study of some learning spaces, designed under the PST framework, over the timeframe of the project. One observation made from such delays was that stakeholders tend to revert to traditional approaches for designing learning spaces when faced with delays and restricted funding. This prompted the team to conclude that one key factor to the success of the PST design framework was stakeholder discipline in following its principles.

The amount of material centered on the evaluation of learning spaces, presented in papers from twelve different Australian universities, amply demonstrates the wide application of the theory underlying the PST framework. Learning and teaching spaces, with budgets ranging from under \$40,000 to \$640,000, were effectively evaluated using the PST framework.

From reactions to the colloquia the PST framework has struck enormous resonance.

When asked to consider the importance of the PST relationship in the design and use of new learning spaces within higher education institutions, an impressive 88% of delegates responded that it was a vital element. This feedback confirmed that the application of the PST framework in the early stages of collaborative planning, prior to construction, was the best approach. The PST framework provides guidance and a template for evaluating new learning spaces, from the initial concept to the assessment of learning outcomes.

(Tibbetts, 2008)

Comments provided in response to a delegate survey crystallised some vital aspects of the debate.

Delegates expressed the view that the Pedagogy-Space-Technology framework directed the planning of a new learning space to include specific learning outcomes. These outcomes would in turn, provide a basis for evaluation of the space.

Several institutions revised the initial collaborative phase of planning for new learning spaces, to include input from various sectors not previously considered. Anecdotal evidence supports this change in approach to new learning spaces, and suggests that it has

contributed to reducing the tension in planning committees, as all parties are now working with greater understanding toward a common end.

(Tibbetts, 2008)

Sharing of Project Outcomes

The following is a breakdown of the ways in which the NGLS project outcomes have been shared across the higher education sector. The design of the project incorporated dissemination as a key element in the form of two national colloquia. Although the extent to which the NGLS research has been shared is considerable, a number of secondary effects have increased the distribution markedly and set the agenda for much wider discussion.

Primary Dissemination

Colloquia

The colloquia have proved a powerful and effective way of sharing the PST design framework and the immediate statistics are compelling; a total of 256 participants from a total of 54 institutions. All but three Australian higher education institutions have been involved in the NGLS Colloquia.

A detailed analysis of participation revealed the impact of these Colloquia. Several of the case study presentations prompted delegates to change their approach to planning and evaluating new learning spaces, and confirmed the path taken by others in developing learning spaces. The sharing of information among colleagues and the role of evaluation were reported as the two most significant aspects of the NGLS Colloquia. Fittingly, given the nature of the framework itself, the participants in the program have come from diverse areas within the tertiary institutions, helping to distribute and embed the concepts in the very areas where they will be of greatest value to the sector. A community of stakeholders keen on developing learning spaces through collaboration has grown through the NGLS colloquia. This community has strong national links between higher education institutions and is focused on sharing knowledge on the design and evaluation of new learning spaces. The community included policy makers such as deputy vice-chancellors and university librarians alongside practitioners such as architects, facility managers and technologists. A detailed list of delegates is included in the NGLS Colloquium Reports (Appendices 4 and 5).

Website

The Next Generation Learning Spaces Project website (www.uq.edu.au/nextgenerationlearningspace/) has provided a range of resources to participants and interested parties and will continue as a repository for the framework itself, along with a range of case studies, references and other resource links under the patronage of the University of Queensland.

Publication

The eighteen case studies presented at the 2008 Colloquium, along with framing chapters which reflect the context of the work, will be made available as a separate publication in both printed and electronic form.

Secondary Dissemination

Following the Inaugural Colloquium, a number of presentations were made which either summarised or expanded upon the outcome.

- Derek Powell presented a summary of findings for the ALTC 'Places and Spaces for Learning' Seminar Series in September 2007, to audiences in Adelaide, Perth and Sydney.
- Further dissemination occurred with participants in Brisbane.

- Hamilton Wilson presented a seminar entitled 'Process and the PST Framework' to teaching technology managers from more than 20 Australian universities at the Association of Educational Technology Managers (AETM) conference in Darwin in November 2007.
- Professor David Radcliffe and The University of Queensland Librarian, Keith Webster, have taken the message internationally via a number of presentations to their peers in the USA and Asia.

In addition, there is significant anecdotal evidence that the message was shared within a number of key stakeholder groups which were well represented at the Colloquia:

- Facilities Management;
- Librarians; and
- University Executives.

Links with other projects in the ALTC Strategic Priority Areas

- 'Spaces for Knowledge Generation: a framework for designing student learning environments for the future.' (2008) K. Souter, M. Riddle, S. Jones (La Trobe University), M. Keppell (Charles Sturt University), R. Bienvenue (Kneeler Design), C. Feil (Apple). (www.latrobe.edu.au/teaching/altc-projects.html; www.skgproject.com)
- 'Developing a comprehensive evaluation model for learning spaces.' (2008) N. Lee (Swinburne University of Technology), J. Dixon (Victoria University), T. Andrews (University of Queensland).
- 'Studio Teaching Project.' (2008) Zehner, R. & Forsyth, G. (College of Fine Arts, University of New South Wales)

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