RETROFITTING uni learning spaces

Retrofitting University Learning Spaces

Design principles for the cost effective redevelopment of existing spaces

AUSTRALIAN LEARNING & TEACHING COUNCIL
Promoting excellence in higher education

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In a way I think it's like, you hear people say, like on Master Chef for example, they say you eat with your eyes. Well it's the same with this, if you come into a building, oh, I want to go in there. So with this it's the same, you learn too with your eyes.

University student on why the aesthetics of space matters to them

Acknowledgements

Support for this project has been provided by the Australian Learning and Teaching Council, an initiative of the Australian Government Department of Education, Employment and Workplace Relations. The views expressed in this report do not necessarily reflect the views of the Australian Learning and Teaching Council Ltd.

2010

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INTRODUCTION

The need for learning space redevelopment has been well documented in the higher education literature worldwide (Higher Education Funding Council for England, 2006, p. 9; Oblinger, 2006; Scottish Funding Council, 2006; Strange & Banning, 2001; Van Note Chism & Bickford, 2002). Early higher education initiatives were in the library sector (Bailey, 2005; Bennett, 2007; Forest & Hinchcliffe, 2005) where the significant impact that information technology has on knowledge, knowledge management and knowledge access and retrieval was identified. The current focus for learning space design has a large emphasis on ingenuity to leverage existing technologies with which to build aspects of the "future" campus learning space today (Milne, 2007).

Current literature presents a range of learning space design guidelines with approach adoption based on numerous factors such as organisational goal alignment, resources and exogenous factors such as social trends and behaviours of students. Strange and Banning (2001) investigating campus environments, proposed a campus design matrix that considers four conditions for effective learning; inclusion, safety, involvement and community and four different environmental components; physical, aggregate, organisational and socially constructed. Their broader analysis, they suggest, can be used to plan, design and evaluate learning space redevelopment. Long and Crawley have proposed a different view of the design process. This new view, based on the Conceive, Design, Implement, Operate process of engineering (CDIO), begins with seeing the learning environment as a "product" to be developed rather than simply a space to be redesigned. The product has certain characteristics that are based on the institution's values about learning, or "learning principles". These learning principles become the driving force within the design process and are the benchmarks through which progress is measured and decisions are made.

In Australia, some trial developments exploring space, pedagogy and technology nexus, influenced by the studio physics movement that was initiated in the 1990s, occurred in a number of Australian Universities (P. Jamieson, Fisher, Gilding, Taylor, & Trevitt, 2000; Radloff, 1998). More recently, the Australian Learning and Teaching Council has been leading learning space conversations at a national level. The 2007 Carrick "Places and Spaces for Learning Seminar Series" (2007) highlighted the need for a convergence to redevelop existing classrooms. The opportunity exists to not only modify and/or outfit existing structures but to discover exciting new ways to enable and facilitate student learning (Crisp, 2007).

Consistent themes that appear across the literature, including the need for learning/learner alignment, the need to design for flexibility and the need to cater for rapidly evolving information and communication technology, together with great numbers and diversity of student cohorts, provide opportunities and require changes in the approaches to teaching used in higher education. These changes are a combination of physical, virtual and pedagogical with environments for learning requiring flexibility and the ongoing ability to respond to future technologies and the ever increasing technologically competent and connected student body. Flexibility, diversity, future proofing, ICT integration and collaboration appear to be concepts especially associated with changes to formal teaching spaces and informal learning spaces.

Literature published at the end of the last century, Norris (1998, p. 2) predicted that ‘space design has become the new frontier of innovation’ envisaging ‘multifunction spaces and fused use facilities’ that will be used to ‘retrofit existing facilities’. The current literature supports this and provides insight into the key considerations for institutions when building ‘future’ campus learning spaces. These considerations are often founded on ‘best practice’ ideals on how to deploy technologies that encourage and support interaction, design spaces that adapt to new pedagogic learning approaches and diversity of student cohorts (Higher Education Funding Council for England, 2006; Milne, 2007; Scottish Funding Council, 2006).

Because of the complexity of the student, space and academic triad in relation to pedagogy, any considerations of ‘future proofing’ spaces must be based on the notion that ’we cannot anticipate future technological or pedagogic developments but ensure that designs will accommodate change‘ (Higher Education Funding Council for England, 2006). Similarly, the Scottish Funding Council (2006, p. 1) found that ’the increasing diversity of student populations has prompted a new, more tailored, approach to learning‘ and that ’new environments for learning are being designed or reshaped, in response to changing pedagogical styles, to incorporate new information technology and to adapt to changing numbers and abilities of learners. Investment in learning spaces should not be seen as a “once off” project but rather that the building designed today will change electrical infrastructure once, furniture at least twice, and software systems fifteen times or more over the life of the space.’ (Long & Ehrmann, 2005).

Taking this into consideration space flexibility is a key consideration when designing ‘future’ learning spaces. Moves should be made to transition from a fully ‘static’ designed space to a model where the flexibility of technology and physical space provides the appropriate environment to facilitate engagement, space ownership and adaptability (Seely Brown & Adler, 2008). Students now generally carry at least one portable computing device and the norm is often several devices, ranging from mobile phones, laptops, MP3 Players and even portable game players (Milne, 2007).

As mobiles devices become more embedded in everyday life and the ubiquitous mobile experience continues to evolve, systems embedded in physical spaces should aim to provide richer interaction opportunities appropriate to the kinds of activity the spaces are designed to support. Therefore learning spaces should enable and support technologies brought into the space, rather than aiming to provide often costly static technology solutions built into the space (Long & Ehrmann, 2005). The same approach can be applied to furniture. Instead of having rows upon rows of desks facing in one direction, which is non-conducive to facilitating group work or informal learning activities, spaces should aim to provide students with ownership and flexibility to easily move space furniture and reconfigure it to suit group sizes and activity requirements (Oblinger, 2006).

In recent years, a number of universities have developed and evaluated signature learning spaces designed to support a range of existing and emerging approaches to learning. While adopting a range of innovative design strategies, the high cost of these facilities limit the construction of ‘high tech’ spaces to a few institutions. The reality for most students and academics is that their formal learning activities occur in rooms “configured for a teacher to be seen and heard and for students to take notes” (Van Note Chism, 2002, p. 9). What is needed is an integrated set of principles that allow for the most effective redevelopment of a broader spectrum of existing spaces in universities and the development of classrooms that are usable for future needs.

BACKGROUND

The recent literature on learning spaces is replete with suggested principles for learning space design (Brown & Lippincott, 2003; Higher Education Funding Council for England, 2006; P. Jamieson, et al., 2000; Johnson & Lomas, 2005; Long & Ehrmann, 2005; Milne, 2006; Oblinger, 2006; Scottish Funding Council, 2006). The table below outlines some of the more widely cited sets of general principles that can be found in the learning spaces literature often based around the concept of "next generation" learning spaces. These principles are presented in order to assist universities develop spaces that respond to emerging pedagogies which see learning as a more active, collaborative and engaging activity.

TABLE 1 - COMMON LEARNING SPACE DESIGN PRINCIPLES

Jamieson et al - Place and Space in the Design of New Learning Environments 2000
• Ensure multiple use concurrently and consecutively • Maximise the inherent flexibility within each space • Make use of the vertical dimension of facilities • Integrate previously discrete campus functions • Maximise teacher and student control • Maximise alignment of different curricula activities • Maximise student access/use/ownership of learning environments
Long and Ehrmann - Future of the Learning Space 2005
• Optimise for learning activities; not just stuffed with technology • Enabling technologies brought into rather than built into the space • Invisible technology & flexible use • Emphasize soft spaces • Useful across the 24hr day • Zone for sound and activity
Johnson and Lomas - Design of the Learning Space: Learning & Design Principles 2005
• Innovation and Excellence • Adaptability • Manageability • Accessibility • Atmosphere • Sustainability
Oblinger – Learning Spaces 2006
• 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 • Reflect institutional values
JISC - Designing Spaces for Effective Learning 2006
• 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 • Enterprising: to make each space capable of supporting different purposes

The principles cover a wide range of topics but there are some common themes:

- Design for learners and learning, not technology.
- Support a range of different pedagogical approaches.
- Be creative and bold and look beyond present demands.
- Plan for technologies brought into the space.
- Allow for greater levels of learner control of spaces.

These general principles are adopted, refined and sometimes incorporated into policy by institutions seeking to articulate some type of general principles of learning space design that might cover a range of different learning space types. For example:

Queensland University of Technology 2005

- Pedagogy as the driver: Empowering academics to achieve their curriculum objectives.
- Flexibility: Design should include many options and exclude few.
- Interaction: Creating collaborative learning environments.
- Simplicity: Notion of simplicity in exercising control should be paramount.
- Connectivity: connectivity amongst students in the room, and elsewhere throughout the University.
- Costs: All learning space design is constrained by affordability and sustainability.

Denison University (Denison University, 2009)

- 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.
- Sufficient resources must be allocated for learning spaces.

While the evidence that space matters is becoming increasingly clear (Scott-Webber, 2004), the evidence that any specific design principle, design approach or design model is better than another or is proven to lead to better learning outcomes is still largely absent in the literature (Clark, 2002). Much of the 'evidence' to date is largely anecdotal or based on casual observation (Temple, 2007). It can be argued that this is because space alone does not lead to better learning outcomes, but rather it provides the affordances that new pedagogies need to achieve their objectives. The evidence that new pedagogies provide better learning outcomes is relatively strong by comparison and most institutions are comforted by the belief that new space is an essential element to supporting new pedagogies and therefore warrants the investment being made.

It is worth noting, at least for the purpose of completeness, that this final contention is still being debated with considerable evidence that strong pedagogical design well delivered and supported will triumph in fairly traditional learning environments. Anyone who doubts this need only look at the learning spaces in many of the world's highest performing universities to see that the prevalence of didactic space does not limit the achievement of high learning outcomes. This is not to say that

very poor space cannot impede even the best learning experience (Commission for Architecture and the Built Environment, 2005).

This dichotomy might be explained with a concept that is well known in the service quality domain where the difference between the minimum standard acceptable and the level at which a service 'delights' the users can be quite broad. This concept known as the 'zone of tolerance' (Zeithaml, Parasuraman, & Berry, 1990) can provide a useful filter when considering the value of many design principles. Students and academics expect all learning spaces to meet some minimum standards in terms of lighting, acoustics, comfort and safety, but beyond this there is a considerable zone before the nature and quality of the space is something that they would see and recognise as having a positive impact on their learning styles and outcomes.

However, it is clear that the adoption of these broad learning space design principles has led to the development of a wide range of high quality spaces, and these spaces are undoubtedly significant improvements over previous more didactic learning spaces. It is also equally clear that the design and development of many of these spaces represents significant investments by institutions in terms of the people costs associated with design and the construction costs associated with development. Despite this level of investment, we identified three common problems with many new learning spaces when we considered their impact on the broader learning environment of the institution as a whole.

The first problem, as described by Stuart (Lippincott, van den Blink, Lewis, Stuart, & Brady Oswald, 2009, p. 10) in a recent EDUCAUSE Review article, is that overly engineered designs can 'become statements to a kind of perfection'. He goes on to argue that obviously no space can be perfect and what is needed is a spaces that becomes a type of experiment where the space is highly malleable and can easily be transformed to suit the needs of users. There is a need to ensure that we do not design new spaces in such a way that they are as expensive to reconfigure as they were to develop in the first place.

The second problem is that the level of investment involved in many of those learning spaces held up as leading exemplars prohibits replication for even the mostly wealth of institutions. Even within those institutions that can afford such developments, the space developed often constitutes less than 5% of the institution's total available formal learning space. The reality for most students and academics is that their formal learning activities still occur in rooms which have their origins in the traditional didactic mode of instruction with little or no support for new pedagogical approaches.

Finally, it is perhaps better to describe most learning space design principles as higher order design heuristics as many are more rules of thumb rather than any type of evidenced based principles whose adoption are proven to result in improved learning outcomes for students.

Recent research into learning spaces has resulted in a number of different frameworks designed to tie together a variety of learning space perspectives (Carrick, 2007; Gee, 2006; Nair & Fielding, 2005).

Radcliffe, Wilson, Powell and Tibbetts (2009) present a range of case studies from around Australia commonly grouped around the Pedagogy, Space, Technology nexus. This framework provides a useful starting point in the development of a multi perspective set of guidelines to inform the

redevelopment of learning spaces but we would argue that it leaves out one key element – the perspectives of the people who use the spaces on a day to day basis as well as those who are responsible for their design development and ongoing management.

While implicit within the pedagogy/space/technology framework, it is important to recognise that it is only through the involvement of a wide range of people that these elements become real. For students, formal and informal learning spaces represent an important element of their learning experience. They can help motivate and engage or they can act to distract and distance students from the learning ambitions. For academics, learning spaces can either help enable or impede them in the design and delivery of new, innovative and high quality learning activities. Finally, facilities management, information technology and audio visual staff along with, architects, builders, as well as university finance and senior management, all have an impact on the implementation of any design process.

Each of these key groups may emphasise or ignore any particular set or subset of principles or introduce entirely new design principles into the design process. As Valenti (2005) notes, the people who begin a design process are often not those who complete it. Decisions are made at various stages where functionality and performance levels, technology and building standards, operations and maintenance requirements are all balanced against key questions about the appropriate design to support student learning outcomes.

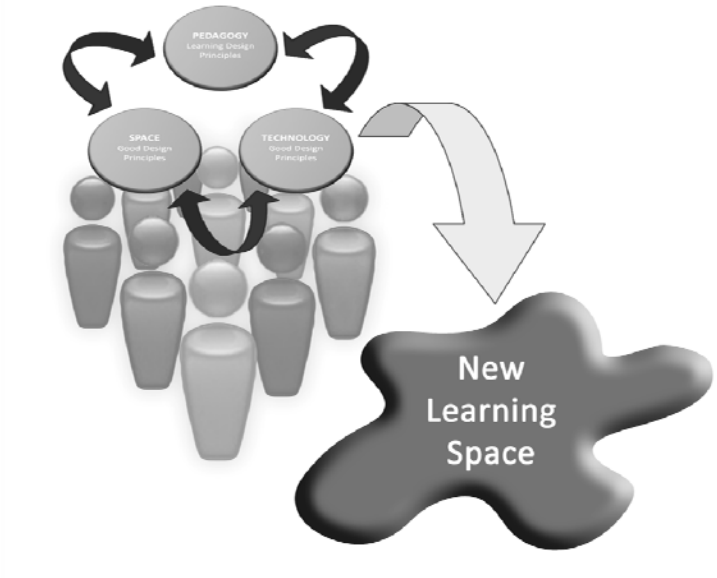

FIGURE 1 – ADDING PEOPLE TO THE PST LEARNING SPACES FRAMEWORK

Starting from this enhanced perspective, this report sets out to establish guidelines and principles that can inform the redevelopment of the larger number of formal learning spaces across the institutions to enable the use of 21st Century technologies and pedagogies.

With this focus it is important to note that the problem domain for these design principles is as follows:

- Designs to support retrofitting of centrally timetabled teaching and learning spaces
- Designs that privilege no single audience, but support a range of audiences
- Designs that focus primarily on formal spaces, but include informal space as it relates to structured learning activities

The report first explores the wide array of learning space guidelines and principles available in recent literature from the three related principles; pedagogy, space and technology. Following this review of the literature, the principles identified are filtered through the various 'people' lens of key stakeholder groups associated with the use and management of learning spaces - students, academics and professional and support staff. Ultimately the report produces a condensed set of principles that it hopes are consistent with academic and student ambitions in terms of learning outcomes and are coherent to those responsible for the design, development and ongoing management of learning spaces.

COMPILING A DETAILED SET OF PRINCIPLES

Much of the design associated with next generation learning spaces is often related to the notion of the dawning 'Interaction Age' which is characterised by the extension of existing technologies and new technologies to emphasise interactivity over mere static content delivery for learning processes (Milne, 2007). Carmean and Haefner (2002) suggest that deeper learning that occurs when learning is social, active, collaborative and promotes a sense of student ownership. Oblinger (2006) further suggests that ongoing changes in the nature of our learners, as a result of ubiquitous access to a range of digital technologies requires a rethink of our learning spaces, recognising the power of 'built pedagogy'- how space can define how one teaches. If we take each of these principles (learning, space and technology) as an empirically grounded starting point, we can derive a set of learning space principles grounded in learning outcomes literature rather than anecdotal evidence.

INFORMING SPACE REDEVELOPMENT – THE PEDAGOGICAL PERSPECTIVE

The desired nature of learning continues to evolve from the transmission model that viewed teaching as the act of telling to more fluid models that see learning as a social activity, where knowledge is both constructed and contested (Van Note Chism, 2002). The social learning aspect of this has been described as a shift from the Cartesian perspective of learning founded on the basis of "I think, therefore I am" to the social view of learning in which "we participate, therefore we are" (Seely Brown & Adler, 2008).

However, it is worth noting that this is a shifting field and the Designing Spaces for Effective Learning report in the United Kingdom (Higher Education Funding Council for England, 2006) suggests that the design of most general teaching spaces will usually need to support both traditional model tutor-led and emerging learner-led activities. This is because pedagogical approaches preferred by students tend to be collaborative and active, while existing spaces and academic practices will be quite diverse, based on course curriculum.

Either way, if we start from the pedagogical premise that learning space design should be learning focussed (Bergsagel et al., 2007; Long & Ehrmann, 2005; Oblinger, 2006) then the ideal starting point must be based on supporting a set of desired or 'ideal' learning behaviours. Starting with Chickering and Gamson's "Seven Principles" (1987) a range of learning principles have been presented in the last few years (American Association for Higher Education, American College Personnel Association, & National Association of Student Personnel Administrators, 1998; Bransford, Brown, & Cocking, 2000; Carmean & Haefner, 2002).

Scott-Webber (2004) suggests that principles like those developed by the American Association for Higher Education and others (American Association for Higher Education, et al., 1998) helps us put learning and knowledge sharing in context. These principles include:

1. Learning is fundamentally about making and maintaining connections: Biologically through neural networks, mentally among concepts, ideas, and meanings, and experientially through interaction between the mind and the environment, self and other, generality and context, deliberation and action.

2. Learning is enhanced by taking place in the context of a compelling situation that balances challenge and opportunity, stimulating and utilising the brain's ability to conceptualise quickly and its capacity and need for contemplation and reflection upon experiences.

3. Learning is an active search for meaning by the learner constructing knowledge rather than passively receiving it, shaping as well as being shaped by experiences.

4. Learning is developmental, a cumulative process involving the whole person, relating past and present, integrating the new with the old, starting from but transcending personal concerns and interests.

5. Learning is done by individuals who are intrinsically tied to others as social beings, interacting as competitors or collaborators, constraining or supporting the learning process, and able to enhance learning through cooperation and sharing.

6. Learning is strongly affected by the educational climate in which it takes place; the settings and surroundings, the influences of others, and the values accorded to the life of the mind and to learning achievements.

7. Learning requires frequent feedback if it is to be sustained, practice if it is to be nourished, and opportunities to use what has been learned.

8. Much learning takes place informally and incidentally, beyond explicit teaching or the classroom, in casual contacts with faculty and staff, peers, campus life, active social and community involvements, and unplanned but fertile and complex situations.

9. Learning is grounded in particular contexts and individual experiences, requiring effort to transfer specific knowledge and skills to other circumstances or to more general understandings and to unlearn personal views and approaches when confronted by new information.

10. Learning involves the ability of individuals to monitor their own learning, to understand how knowledge is acquired, to develop strategies for learning based on discerning their capacities and limitations, and to be aware of their own ways of knowing in approaching new bodies of knowledge and disciplinary frameworks.

While these are not the only set of learning principles available they are certainly consistent with much of the thinking in the field and perhaps, more importantly, already proven in terms of being useful to help guide the development of learning and teaching activities like assessment design. Table 2 - Mapping Learning Principles to Learning Space below takes each one of these principles of deeper learning and derives the relevant learning space principles necessary to enable this form of learning to occur.

TABLE 2 - MAPPING LEARNING PRINCIPLES TO LEARNING SPACE DESIGN GUIDELINES

Learning Principles:	Derived Learning Space Principles
1. **Learning is** about making and maintaining connections	**Learning spaces should** make it easy for students to access relevant resources and learning materials **Learning spaces should** support easy interaction between students and with academics
2. Learning is enhanced by taking place in the context of a compelling situation	**Learning spaces should** help create a sense of stimulation and excitement **Learning spaces should** reflect the values of the institution
3. **Learning is** an active search for meaning by the learner	**Learning spaces should** support student construction of knowledge **Learning spaces should** support active engagement rather than passive receipt of knowledge.
4. **Learning is** developmental, a cumulative process, integrating new with the old	**Learning spaces should** make it easy for students to build from previous knowledge **Learning spaces should** make it easy for students to share knowledge
5. **Learning is** done by individuals who are intrinsically tied to others as social beings	**Learning spaces should** support high degrees of movement, activity and interaction **Learning spaces should** be flexible enough to support both individual and group activities
6. **Learning is** strongly affected by the educational climate in which it takes place	**Learning spaces should** be safe, comfortable and free from external distractions **Learning spaces should** assist learners to be an active part of the university community
7. **Learning requires** frequent feedback if it is to be sustained, practice if it is to be nourished, and opportunities to use what has been learned	**Learning spaces should** facilitate academics in monitoring and engaging students in their learning **Learning spaces should** facilitate academics providing feedback on student activity
8. **Much learning** takes place informally and incidentally	**Learning spaces should** cluster formal and informal spaces to support easy transition **Learning spaces should** support opportunities for accidental or serendipitous interaction between students and academics
9. Learning is grounded in particular contexts and individual experiences	**Learning spaces should** be cognizant of cultural requirements and celebrate diversity **Learning spaces should** assist the connection of the university as a broader community of learners
10. **Learning involves** the ability of learners to monitor their own learning	**Learning spaces should** allow students to capture learning outcomes for latter review **Learning spaces should** help draw out reticent students

INFORMING SPACE REDEVELOPMENT – THE SPACE PERSPECTIVE

The Commission for Architecture and the Built Environment in the UK in its report "Design with Distinction" (Commission for Architecture and the Built Environment, 2005) argues that space design has an influence on a number of key performance indicators for higher education institutions including:

- **Recruitment:** A positive influence on a student's decision to study in a higher education institution (especially true for post graduate students)
- **Retention:** A positive influence on the way a student feels and behaves while they are studying, including their decision to continue studying at that institution
- **Performance:** A positive influence on student's motivation, facilitating creativity and inspiration and facilitating key elements of course content.

Despite this, there is little support for the architectural determinism notion that space alone determines or ensures the adoption of any set of behaviors. Rather, the role of space is perhaps somewhere between the architectural and architectural probablisim perspectives described by Strange and Banning (2001). That is, space offers affordances, provides cues as to likely intended uses, and privileges some behaviors over others. In the same way that Strange and Banning argue that a university without a football stadium would find offering a football programme difficult, so too might an academic looking to introduce more active forms of learning find it difficult if the only spaces available were tiered lecture theatres.

Given the view that different spaces makes different types of learning behaviors possible/probable then it is clear that universities need a range of different types of spaces if the wide range of new and emerging approaches to learning are to be supported. The challenge moves from what makes an effective learning environment, to what collection of spaces is needed to support an effective learning community.

Scott-Weber's In Sync publication (2004) presents one collection of different types of learning spaces, based on their suitability in terms of different aspects of knowledge manipulation:

- Spaces for Delivering Knowledge –lecture halls, fixed classrooms
- Spaces for Applying Knowledge –design studios, computer labs, research labs
- Spaces for Creating Knowledge –project rooms, team spaces
- Spaces for Communicating Knowledge –cyber cafes, learning commons
- Spaces for Decision Making –board rooms, conference rooms

With the nature of the activity (for example desirable proxemic zones attributes), Scott-Weber presents elements such as suggested floor layouts, guidance for the application of technology and guidance for suggested relationships between various space types. This approach reflects something that has been common in the K-12 sector for a number of years. Based on observation of outcomes (although not always learning outcomes) various authors (Bergsagel, et al., 2007), architectural firms (Nair & Fielding, 2005) and education based websites (DesignShare, 2009; National Institute of Building Sciences, 2009) have presented collections of 'proven' learning space patterns.

Nair and Fielding in their book "The Language of School Design: Design Patterns for 21st Century Schools" (2005) present 25 patterns that are explained through diagrammatic examples of floor plans, images and architectural sketches of key elements. Although largely derived from the K-12 sector their patterns include a range of easily recognisable spaces found in tertiary education, as well as a number of less obvious space patterns including:

- Classrooms, learning studios and small learning communities
- Welcoming entries
- Student display spaces
- Science labs
- Performance spaces
- Interior and Exterior Vistas
- Flexible Spaces
- Campfire Spaces
- Watering Hole Spaces
- Cave Spaces

These collections of patterns build from a set of principles about student learning and present a range of ideas that can be adopted in a variety of different ways to enhance space design activities. Despite the visually appealing and easily applicable nature of these space design patterns, it isn't clear that the success of the pattern is based any more on learning outcome than it is on the more well established space design linkages such as space conveying a sense of the institution's culture, and space setting expectations about an institution's attitudes towards its students and the community. However the authors argue that 'there are certain recognisable patterns that define healthy spatial relationships' (Nair & Fielding, 2005, p. 8).

It has been noted that the purpose of many of these types of spaces extends beyond just the domain of learning outcomes and into a range of broader campus planning objectives including:

- Conveying a sense of the culture or gravitas of an institution of higher learning (Kenney, Dumont, & Kenney, 2006)
- Convey a sense of community for members of the University (Kuh, Kinzie, Schuh, & Whitt, 2005)
- As a marketing tool for attracting both potential students and research partners (Commission for Architecture and the Built Environment, 2005; Edwards, 2000)

There is also considerable cross over between learning spaces design and campus planning and more general workplace design and general space design arenas. Research undertaken by the American Society of Interior Designers (American Society of Interior Designers, 2001) suggests that there are four main issues that people in general value in a workplace. These are:

- The **comfort** of the workplace, ranging from the physical comfort to the atmosphere or feel of the environment
- Open and effective **communication**
- Having **access** to the people, places and things necessary to be productive
- Having a **functionally efficient** environment

Simmons (2009), in his role as the Chief Executive for the Commission for Architecture and the Built Environment in the UK, suggests that there are three important principles to good space design in general:

- Robustness or durability.
- Usefulness or efficiency.
- Beauty or the ability to delight.

These general principles can then be considered in some detail to identify more specific space principles. These principles include:

1. Space should be useful, built to last and easy to maintain
2. Spaces should facilitate quality of life for the users
3. Spaces should be easy to move around in and allow users to find their way
4. Spaces should relate well to other spaces
5. Spaces should be flexible and respond to changing use over time
6. Spaces are environmentally efficient
7. Spaces should help their user to work more effectively
8. Spaces should prompt users to express pride or delight in their use

If we take these principles as a starting point we can again extract the general learning space principles necessary to enable them.

TABLE 3 - - MAPPING SPACE DESIGN PRINCIPLES TO LEARNING SPACE DESIGN GUIDELINES

Space Design Principles:	Derived Learning Space Principles
1. Space should be useful, built to last and easy to maintain	**Learning spaces should** be robust and fit for ongoing use **Learning spaces should** be designed giving due consideration to ongoing maintenance
2. Spaces should facilitate quality of life for the users	**Learning spaces should** be a healthy working and learning environment **Learning spaces should** minimise any consequences and risks associated with accidental or unintended actions
3. Spaces should be easy to move around in and allow users to find their way	**Learning spaces should** be easy to access and navigate for all users **Learning spaces should** encourage the notion of simplicity in exercising control over events in the room and its systems
4. Spaces should relate well to other spaces	**Learning spaces should** be redesigned in conjunction with planning for adjacent spaces **Learning spaces should** allow for a flow of pedagogical activities in and around them rather than an unconnected set of learning events.
5. Spaces should be flexible and respond to changing use over time	**Learning spaces should** support a range of different learning activities without the need for excessive reconfiguration **Learning spaces should** be easily reconfigured to support new and emerging learning requirements

Space Design Principles:	Derived Learning Space Principles
6. Spaces are environmentally efficient	**Learning spaces should** be designed to utilise resources and technologies that are environmentally sustainable **Learning spaces should** support users to learn about and be environmentally conscious in their learning activities
7. Spaces should help their user to work more effectively	**Learning spaces should** facilitate easy movement of learners around the space **Learning spaces should** create minimal cognitive dissonance for their users
8. Spaces should prompt users to express pride or delight in their use	**Learning spaces should** convey a sense of engagement and excitement **Learning spaces should** encourage a sense of ownership by both staff and students

INFORMING SPACE REDEVELOPMENT – THE TECHNOLOGY PERSPECTIVE

While there is an ongoing debate about the nature of the relationship between technology and pedagogy, there is little argument that the impact has been considerable (Carlson, 2005; Dori & Belcher, 2005; Milne, 2007; Roberts, 2005; Seely Brown & Adler, 2008; Williamson & Perkins, 2009), even if only at the level of learning and teaching practices rather than on fundamental pedagogical models (Temple, 2007).

What is clear is that the debate has progressed from a perception that there had been no major changes to pedagogical models despite the level of technology introduced into learning spaces (Becher & Kogan, 1992) to a view that assumes students involved in new pedagogical approaches like active learning will have ready access to relevant support resources, especially IT (P. Jamieson, Dane, & Lippman, 2005). For many the possibilities of IT are summed up by Seely Brown and Adler (2008) who argue that one of technology's main possibilities lies in its ability to support the shift from Cartesian views of learning "I think therefore I am' - to a social view of learning - 'I participate therefore we are'. This view suggests that the openness of Web 2.0 type technologies and the communities that they sustain signal a new form of learning – Learning 2.0.

The emergence of Web 2.0 technologies, ubiquitous mobile devices and virtual environments is encouraging and supporting interactions. Web 2.0 technology, with its basic premise of user generated content, enabled asynchronous social networking repositories are one example of the advancements. Communication tools such as text messaging, VoIP, instant messaging, IP-based conferencing, and multi-user collaboration systems further increase the trend towards real-time social interaction.

Social software products are emerging in various forms ranging from tools that provide annotated information repositories (Flickr), online journaling (blogs), community-editable websites (Wikis, Facebook, MySpace) and interactive shareable documents (Writely, GoogleDocs) (Milne, 2007). Game-based virtual environment approaches are encouraging and supporting interaction by implicitly promoting the idea that students need to be actively engaged with digital resources. Virtual reality worlds like Second Life are identified as possible approaches to providing levels of interactivity and simulation for learning environments. The shortfalls of this approach however is

that they are forcing student interaction to take place through avatars in an artificial world, thus circumventing the all important in situ learning and interactions that would take place in real life (Milne, 2007; Seely Brown & Adler, 2008). As a result, digital environments alone are not a sufficient answer to designing the learning spaces of the future. Rather it is the important consideration of how to blend physical and digital worlds effectively to create environments that preserve the richness of interactions that are not technology-mediated and allow those interactions to co-exist with those that are technology-mediated.

Beyond the domain of virtual worlds and online communities one aspect of learning space design that has received some attention is the need to develop blended learning spaces – spaces that make it easy for students to blend physical and virtual learning activities (Milne, 2006; Powell, 2007). Based on views consistent with those that inform the push for utilisation of social learning approaches, these blended spaces are designed around the need to support collaborative learning activities. Milne (2006)suggests that campuses need to take a range of steps to respond to these emerging needs, including:

- Embracing new design philosophies
- Phasing out function-specific hardware systems
- Providing room-scale peripherals and systems
- Ensuring physical and technological flexibility
- Enabling greater capabilities with pervasive computing infrastructure
- Promoting community by leveraging mobile devices

More recently there has been a focus on a number of themes including:

- The need to decouple IT and AV from their currently fixed positions on walls and ceilings and enable any space to be flexibly provision with technology (Valenti, 2002)
- The need to provide a broader array of information capture systems and solutions allowing staff and students to capture and review classroom activities, record evidence for assessment or store as part of a developing e-portfolio (Brown & Long, 2006; Milne, 2007)
- The desire to take advantage of student provisioned devices (laptops, mobile phones etc) to create interaction in traditionally didactic spaces (Brown & Long, 2006; Long & Ehrmann, 2005; Panettieri, 2007; Powell, 2007)
- The desirability of providing students with the same level of technology access (both devices and software) in informal learning spaces as might be expected in formal learning spaces (Kuh, et al., 2005)

Underpinning much of the literature on technology utilisation in learning spaces are quality design principles for technology that have been discussed in some detail for over 20 years (Schneiderman, 1992). These principles have influenced aspects of technology design ranging from hardware design through to software design (see for example ISO Standard 9126 Software Quality Model) to more recently influencing website design and usability standards (Nielsen, 1999) . While the actual

number and compositions of the principles have been altered slightly over time, their general thrust has stayed the same. The general quality principles are:

1. **Usability** – This principle refers to how easy the system makes it for novice user to learn the system and for the experienced user to use its advanced functionality. This principle can cover a wide range of elements including user efficiency and learnability

2. **Functionality** – More than just the number of functions available, this principle refers to the degree to which the functionality meets the requirements of the user. Related to concepts of suitability, accurateness and correctness, it is important to note the old design maxim which stated that usability should never be sacrificed for functionality

3. **Maintainability** – This principle refers to how well the system can withstand the rigors of constant operation as well as its ability to adapt to changing circumstances. This principle can encompass concepts of robustness as well as flexibility

4. **Reliability** – Related to the concept of maintainability, this principle refers to the degree to which the system can be depended on when required for use. Related strongly to the concept of availability, it refers not just to the frequency of failures but more importantly to the level of dependence that users can place on the system

5. **Extensibility** – This principle has elements of both the degree to which a system might be extended as well as the degree to which the system might be interconnected with other systems. The principle also overlaps a related concept of scalability – that is the ability of the system to both handle the required number of users and its ability to be cost effectively implemented into as many sites as necessary

It is clear that these general and well supported principles can benefit the domain of learning space design as much as they have been shown to lead to better design of technology. If we again repeat the exercise of deriving learning space principles from these general principles we can complete the derivation of principles based on each of the elements of the pedagogy, space, technology framework.

Table 4 - - Mapping Technology Design Principles to Learning Space Design Guidelines

Technology Design Principles:	Derived Learning Space Principles
1. A system or solution should be easy for a novice user to learn and an experienced user to use its advanced functionality	**Learning spaces should** include elements that assist the learning efficiency and efficacy of its users **Learning spaces should** allow the user to focus on the learning activities to be conducted and not on the learning activities required to use the space
2. A system or solution should deliver the function necessary for its users to achieve their desired objectives	**Learning spaces should** be designed based on a clear vision and understanding of users needs **Learning spaces should** be designed using robust design, test and implement procedures
3. A system or solution should withstand the rigors of constant operation as well have some ability to adapt to changing circumstances	**Learning spaces should** be designed giving due consideration to ongoing maintenance **Learning spaces should** be constructed with flexible elements that do not constrain its ability to adapt to changing needs
4. A system or solution should be dependable and provide the user with the necessary confidence that it will be available when required	**Learning spaces should** utilise technology to proactively monitor that state of the space and its systems **Learning spaces should** be easily identified allowing users to find suitable spaces
5. A system or solution should be able to respond to relevant peak demands and be available in a cost effective manner to support its broadest possible use	**Learning spaces should** have sufficient resources for all users of the space irrespective of the configuration **Learning spaces should** be adequately supported by services that allow additional learning resources to be easily allocated

Accepting that many of these principles are closely related they can be reduced to a more comprehensive set of 25. These principles can be loosely grouped into a number of different perspectives:

- Learning Perspective
- Psychological Perspective
- Physiological Perspective
- Spatial Perspective
- Technological Perspective

Table 5 provides a mapping of the 25 principles against each of these perspectives.

Perspective:	Learning Space Principles
Learning Perspective An effective learning environment should be able to successfully support a range of different learning activities and behaviours.	**Active Engagement** Support active engagement rather than passive receipt of knowledge.
	Pedagogical Range Support a range of current and emerging pedagogies.
	Shared Construction of Knowledge Enable and facilitate knowledge construction, sharing and review by all participants.
	Contextual Reinforcement Create environments that clearly promote, support and recognise learning excellence.
	Serendipitous Interaction Support opportunities for accidental or serendipitous interaction between students and academics.
Psychological Perspective An effective learning environment should be welcoming, safe (physically, emotionally and culturally), stimulating and create a sense of belonging for its users.	**Safety and Inclusion** Create a sense of safety, physically, emotionally and culturally to promote staff and student inclusion in learning activities.
	Cultural Diversity Encourage the celebration of cultural diversity.
	Challenge, Stimulation and Excitement Support the creation of compelling situations and actively encourage a sense of stimulation and excitement around the learning process.
	Ownership and Identity Encourage a sense of ownership and belonging by staff and students.
	Communities of Learners Assist the connection of the University as a broader community of learners.

Perspective:	Learning Space Principles
Physiological Perspective An effective learning environment should be accessible, comfortable and habitable for all its users.	**Accessibility** Facilitate ease of location, access and navigation for all users.
	Interaction and Activity Support a high degree of movement, activity and interaction.
	Comfortability Be comfortable and inviting with plenty of natural and variable light, good ventilation and appropriate acoustic treatment.
	Brain Food Provide users with ready access to necessary food and drink and bathroom facilities.
	Connectedness Allow for a flow of learning activities in and around them rather than an unconnected set of learning events.
Spatial Perspective An effective learning environment should be adaptable, reliable, sustainable and easily learnable.	**Usability** Be easy to use and adequately supported by services that allow easy problem rectification or the provisioning of additional learning resources.
	Reliability Be reliable, robust and fit for ongoing use.
	Agility Be agile enough to support a range of individual and group activities during the day, the week, the semester and across the year.
	Adaptability Be adaptable enough to support learning requirements that may emerge or change over time.
	Sustainability Utilise resources and technologies that are environmentally sustainable and support users to be environmentally conscious in their learning activities.

Perspective:	Learning Space Principles
Technological Perspective An effective learning environment should take advantage of technology that facilitates the achievement of the previous principles.	**Human Technology** Include technology that recognises the social nature of learning.
	Simplicity of Design Encourage the notion of simplicity in the design and implementation of technology and systems.
	User Centred Design Develop solutions using robust user centred design, testing and implementation procedures.
	Extensibility Encourage the development of systems and solutions that are easily extended and interconnected with other systems or solutions.
	Technical Agnosticism Avoid the use of technology, systems and solutions that lock the institution or the user into specific platforms or vendors.

TABLE 5 - LEARNING SPACE PRINCIPLES DERIVED FROM THE LITERATURE

While providing useful guidance for the redevelopment of learning spaces, feedback [1] suggested that these 'principles' were perhaps more like guidelines or protocols than fundamental principles. It has been argued that such a large collection of principles runs the risk of becoming little more than a check list, rather than providing guidance about what makes a difference, while still allowing the individual characteristics of any space to shine through in the design process.

To develop a final set of 'principles', greater consideration was needed in terms of the both the nature of the principles, and the way in which they resonate with key stakeholders in learning space design, development and utilisation. The next section of the report considers the perspective of three key stakeholder groups (students, academics and professional, and support staff) in an effort to help distill those principles that most resonate with these groups.

[1] Based on advice from participants at a one day Learning Spaces Colloquium held at QUT on the 26th October 2009 where the first draft of this reduced set of principles were presented

ADDING THE PEOPLE DIMENSION

From the literature, pedagogy, place and technology have been considered and a comprehensive set of design principles and guidelines distilled. However learning spaces are created for people to use and as indicated above, a diverse group of people are primary and secondary users of learning spaces. They range from academics and students, the primary users of formal learning spaces for the business of education, to a broad range of professional and support staff including IT, facilities, AV, space planners, who have various roles in the planning, provisioning, maintaining, securing, and cleaning of learning spaces to enable the business of education to occur. The perspectives of each of these groups in considered in some detail to help identify which of the preceding principles resonate most.

THE STUDENT PERSPECTIVE

> *Great learning spaces = comfort, quiet, privacy, views, lighting, colour!*
>
> *ECU student*

As students are the primary users of learning spaces, it is perhaps surprising that they are often a voice least heard in the planning and development of these spaces (Dugdale, 2009). Understanding their perceptions of how well the existing spaces are performing can better inform when refurbishment is likely. To this end, influenced by a two year undergraduate study at the University of Rochester library (Foster & Gibbons, 2007) in the United States, a technique called photo elicitation was used to 'see the campus through the eyes of the students' (Gibbons, 2007). Essentially this photo elicitation technique is an adaptation of a form of diary study developed by Gaver et.al. (1999) called cultural probes. This technique provides a means of gathering information about people and their activities in environments that are difficult to observe directly. Essentially, a cultural probe involves giving a set of volunteers a kit of materials (the probe) and then briefing them about the requirement to record or note specific events, feelings, interactions over a specified period. Typically, follow up interviews are conducted at some point after the briefing session to help ensure that participants are actively engaged and are collecting the required information (Gaver, et al., 1999).

The photo elicitation technique used at Rochester Library was a photo survey. Volunteer students were provided with a disposable camera with a list of 20 questions attached. When the photo survey was completed, students were asked to return the camera and then take part in an interview about their responses (Foster & Gibbons, 2007). This technique was adapted for use to understand the space perceptions of students in this ALTC project. Generically in each university, students were asked to take photos of positive (best) and negative (worst) learning spaces at various campuses to get a better idea of what students thought about the spaces, especially what are the characteristics of good learning spaces. Due to institutional and project constraints, slight modifications were made to the technique to suit the needs of each context.

Largely mirroring the Rochester photo elicitation, QUT asked volunteer students (10 post grads and 18 undergrads) to undertake a photo survey of 'Best' and 'Worst" specified space types on campus - working alone, working as part of a group, finding information, participating in a tutorial or workshop, learning, attending a lecture , or just hanging out and then spaces that generated a strong

emotional responses; eg anger, frustration or productivity. Students were also asked to complete a task sheet, which was a campus map with space for them to record the location of the places and their reasons for their choices. A one-to-one interview followed the completion of the task sheet and the photos. Follow up interviews were then conducted and these interviews were recorded, transcribed and then later analysed for recurring themes and concepts. This approach was adapted by both CDU and ECU into a less detailed exercise –one that could be conducted in a tutorial setting (CDU) or conducted by library staff (ECU). The approach both of these universities took was to ask just a very broad task - take photos of their positive and negative learning spaces on campus and explain why they thought this. At CDU, approximately 135 undergraduate students studying cultural competence were asked in small groups of two or three to go and photograph the positive and negative spaces for learning on campus and then explain briefly why they thought this. Photos and text were analysed similarly to QUT. At ECU, volunteer students worked with library staff on a similar exercise. Eight students responded and the data they generated was collated and combined with the CDU analysis.

When asking students about positive and negative places for learning on campus, the full gamut of the learning landscape available at universities was captured. Dugdale (Dugdale, 2009, p. 52) describes the learning landscape as the "total context for students' learning experiences and the diverse landscape learning settings available today from specialised to multipurpose from formal to informal and from physical to virtual ". This is certainly what the photo elicitation exercise revealed when the results from the three universities were collated. Interestingly the multi- purpose, informal spaces featured prominently in the student photos studies with the library the most frequently occurring space in the students learning landscape at all three institutions followed by garden and courtyard spaces.

Unlike university space planners, facilities people or academics the responses from students indicate that the temporal nature of learning is prominent in their concept of learning spaces. Learning doesn't begin and end while students are in formal spaces such as lecture theatres or tutorial spaces. In fact when most students were asked what their best learning space was, without specific prompting (e.g. best individual space) the response was very rarely the formal learning spaces associated with instruction, delivery of knowledge or even practice based teaching approaches. Generally good learning spaces were interpreted as places where students actually felt some learning occurred for them and this was invariably the more informal spaces provided by the university specifically for this purpose- libraries, computer labs. However, more often than not, these were spaces that university professional and support staff may not have considered associated with learning - under trees in scenic grassy areas, outdoor benches, courtyards and empty classrooms.

The text analysis identified a numbers of themes and concepts common across students at all universities that focused on the importance of the physical characteristics of the space for learning - light, colour, temperature, furniture, the emotional responses to spaces and their impacts on learning, the access and availability of learning spaces for a range of learning activities, and the ease of use of spaces especially in relation to the support and provision of technology. However, there were some differences in student perceptions at the three institutions relating to access to computers and the physical surroundings in which the university was located. For example, concrete was a key concept articulated by QUT students but not mentioned at all by students from ECU and

CDU whose campuses are in less inner city locations. While access to, and provision of, group spaces were significant for QUT students, this was not an issue for students at ECU and CDU.

Based on a straight frequency count the more popular concepts in the minds of students regarding spaces for learning included work, people, noise, quiet, peaceful, tables, views, relaxing, information, access, chairs, tables, concentrate, group, friends, busy, trees, distractions environment. Figure 2 below presents a more detailed word cloud drawn from a summary of the most commonly found words in student transcripts regarding desirable learning space characteristics.

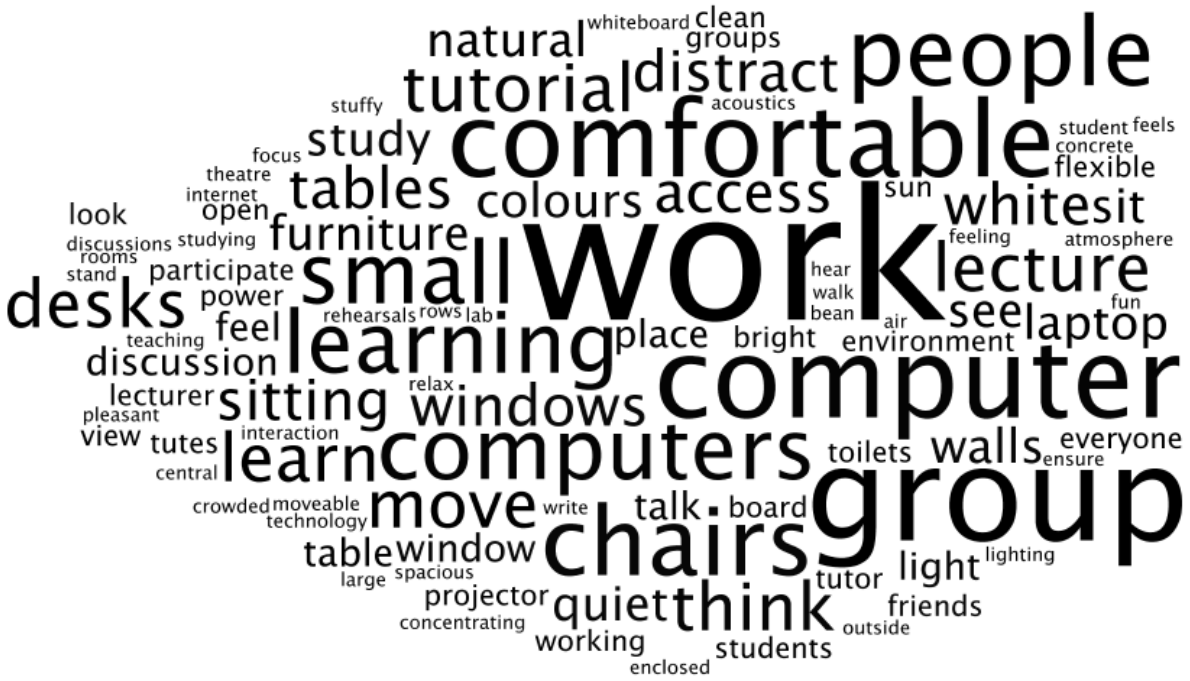

FIGURE 2 - DESIRABLE CHARACTERISTICS OF LEARNING SPACES FROM THE STUDENT PERSPECTIVE

Examining the analysis of student perceptions of learning spaces in more detail, three major themes are identified that make spaces conducive to formal or informal learning:

- Spaces should have a positive ambience with physical characteristics of light, sound, temperature, colour and furniture carefully considered
- Spaces should be accessible and available for a range of learning activities.
- Spaces should be easy to use and adapt with appropriate technology available.

Each of these themes will be explored in more detail in the following sections predominantly using the voice of the students to help explain what works for them. Where possible, the extracts will focus on the more formal spaces (lectures, tutorial rooms, specialist labs) as this is the focus of this project. However other spaces will be included as it relates to the issue being discussed.

Extracts from transcripts are shown indented to clearly distinguish between actual student views and our interpretations of those views. Where appropriate photos of some of the spaces provided as examples will also be included. Modifications, shown in square brackets, are made only to aid the clarity of the various comments.

SPACES THAT HAVE A POSITIVE AMBIENCE

Students in all universities associated the ability to get work done, to study, to concentrate (or the opposite to these learning activities) with the ambience or atmosphere of the learning space. They characterised these in terms of physical characteristics; acoustics, light, temperature/ventilation, type of furniture provided and how it was organised, tables, chairs, layout and the aesthetic appeal of the space - especially the colours used. These aspects were important across all spaces used by students - lectures, tutorials and personal learning spaces (both individual and group). However the focus of the discussion here will be mainly on students' perceptions of lecture and tutorial spaces.

The acoustics, light and temperature of learning spaces featured prominently when students were referring to the more formal lecture spaces:

> *It's a nice space to learn in and you know the microphones never fail, you know it's got really great **acoustics** to it, and it's always a really **comfortable temperature**.*
>
> *QUT student*

Sound control in relation to being able to hear the lecturer or being distracted by noises from other classes was considered important for concentration and focus by many students.

> *I don't know if it's soundproofed or not, but you can never hear any outside noise. You can never hear people walking around behind you or people on the level above you. So there's very very little distraction in the lecture theatre at all*
>
> *QUT student*

> *I mean the other problem is noise would sometimes be a problem when there'd be really loud group discussions like in the next room we couldn't always hear our lecturer, so just a bit more **soundproof**.*
>
> *QUT student*

Invariably students indicated strong positive emotional responses to lecture spaces that enabled them to focus on the business of knowledge sharing without distractions from noise from outside the space and control of the sound inside. The control of sound and noise was even more important for students in their choice of personal learning spaces for individual study and most indicated that this was when they tried to find spaces that were 'empty' or were occupied by very few other people. Empty computer labs or classrooms were popular places for study at both CDU and ECU:

> *We chose this place as a positive study area as it is quiet, there are available computers and it is open to everyone*
>
> *CDU student*

> *It's wonderful if you can find an empty computer lab all for yourself, but 3 or 4 other **quiet** workers is also fine. Computers are an important element for study and learning spaces. This is good because of the computer and printing facilities, it's quiet and **private**.*
>
> *ECU student*

Lighting, natural light, and windows were other concepts that impacted on perceptions students had about spaces to learn. This was very much a personal preference as some students strongly indicated that the availability of good natural light and windows with views invoked feelings of happiness or alertness, while other students found windows in particular a distraction. The range of views are presented below:

> *In this room it's hard to **concentrate**, as the room is too closed (no windows or natural light at all and the separating wall allows noise from the class next door.*
>
> *CDU student*

> *It's a nice lecture theatre, but it's not great, because it's quite dark.*
>
> *QUT student*

> *...there's actually windows which make the room a little bit more **natural** I suppose, whereas some of my tutes which are in Z block, are just kind of concrete and walls are just grey and it's just white rows and you can't open a window, there's no windows there, and if there are, there's blinds, they're always closed and you never really know what time of the day it is if you're in there.*
>
> *QUT student*

> *The large windows at the back of the room tend to distract people as people walk past.*
>
> *CDU student*

> *Yeah, and I think the fact that it is **bright** and it has that good combination of good natural and artificial **light** just gives it that different atmosphere, like a happy sort of pleasant atmosphere, so that's why I like that space, and I was in a lecture one semester where, yeah, we did move the room around a lot.*
>
> *QUT student*

> *And the reason I like this space is because it has: lots of **natural light**, it's got heaps of windows, it's got windows, like huge windows down both walls, and the doors are glass as well.*
>
> *QUT student*

> *This is an example of an excellent classroom to learn in. The most important feature is the big window with a lovely view of the greenery and flowered tree outside. There is nothing worse than a dark enclosed space to work in – the view is **refreshing** and allows you to relax for a moment. It's also great to have some nice **natural light** to work by.*
>
> *ECU student*

However, while light, or the lack of it, evokes strong reactions from students about the suitability of learning spaces, as one student reminds us, there is more to a learning space than the physical characteristics. The people and experiences associated with a space evokes strong personal responses as well:

> *This lecture theatre was the worst place for me. Not because of the dodgy lighting by an equally dodgy motion sensor that caused the lights to go on and off every time someone moved, rather the class that I was taking at the time. [It] was a subject that was vague, abstract and almost failed me.*
>
> *CDU student*

Personalised learning space preferences regarding light are closely associated with concepts of trees, shade, grass, sun, aspects of the outdoor environment for students in most universities or in well lit, spaces in between classrooms. These are characterised by students in the following ways:

> *Definitely a positive about ECU learning environments as you are able to be out in the sun and be close to the lake whilst studying... or it's just a good environment to catch up with friends whilst chilling in the sun.*
>
> *ECU student*

> *…this is a positive space, in the sun, small and cute and it was nice and quiet when we found it.*
>
> *CDU student*

The quality of air and the ambient temperature of a space were identified as impacting on participants' perceptions of comfort and their ability to concentrate in tutorial and lecture spaces. Participants were critical of spaces where the temperature of the space was not regulated being either too hot or too cold, A comfortable ambient temperature was perceived as necessary for work productivity.

> *I believe this was a positive learning space because it is a **spacious**, air conditioned room which has a main focus in the front of the room.*
>
> *CDU Student*

> *and whilst it is **big** and it's **bright**, it's freezing and it's horrible, and we were there right on the cusp of autumn, like coming out summer and we would stand outside and we would be sweating and we'd go inside and we'd need jumpers and scarves.*
>
> *QUT student .*

> *And it's quite old; all of that block's quite old. It's really stuffy,...you can't open a window to get some natural air flow in there.*
>
> *QUT student*

> *The learning space is constricting as the room is very stuffy and crowded*
>
> *CDU student*

So for students, productive learning spaces, whether for personal learning activities or more formal instructional activities, are characterised by the ability to control the lighting (either natural or artificial), the sound (quiet or noisy as needed) and the temperature.

Another important aspect for students at all institutions was the furniture provided in the various learning environments - personal or instructional. Concepts associated with this notion included large, tables, chairs, height, adjustable, layout, movable, fixed, size. Two key ideas are central to student preferences regarding furniture, with flexibility and comfort clearly articulated by students:

> *" I love reading on this **comfy** bean bag, makes me feel at home!"*
>
> *ECU student*

> *It is an absolute luxury and pleasure to have bean bags to sit on for note taking, research, quiet group discussion, working on the laptop etc. It's **comfortable** being able to **relax** and stretch out a bit while you work.*
>
> *ECU student*

> *Like it's inflexible because all the tables are stuck where they are, all the chairs are stuck where they are. It's pretty uncomfortable. Like it's a bit too big. It's a little bit too big, yeah, just stuff like that. I just don't like it.*
>
> *QUT student*

This notion of flexibility is highlighted even further in this very eloquent response from a student at ECU who clearly demonstrates visually why flexibility with the choice of chairs in most spaces is important to students. She explains:

> *As you can see [..], it is my favourite study space because I am able to sit on the chair, and have my arms at a **comfortable** height to work on my laptop. This is the correct position to be working at a computer right?*
>
> *I find sitting at the table [here] extremely uncomfortable. Look at the position of my arms! They are not nice and level, parallel to the ground, but at a horrible angle. I feel like I get pins and needles in my hands if I work like this for too long.*
>
> *ECU student*

As students bring more and more of their personal devices to universities, and these are used more regularly in a range of teaching and learning situations, consideration should be given to the seating provided in both formal and informal spaces, especially about the ergonomic practices they allow or disallow. What the student above had most issue with was as a small person there were only a few places where she could sit comfortably for personal study as the balance of flexible seating to fixed was skewed very heavily to fixed.

Chairs proved to be a significant feature in students' perceptions of lecture theatres. Generally the type of chair impacted considerably on the comfort levels of students in longer lecture situations.

> *Oh, not so good are the chairs. They're ordinary plastic chairs, very uncomfortable for a 2 hour lecture or a 2 hour tutorial. They sort of get a little bit uncomfortable.*
>
> *QUT student*

> *Really uncomfortable chairs for a 4 hour lecture*
>
> *CDU student*

> *I think, yeah, like comfortable chairs and the tables that are at a reasonable height and don't fall over…. I think that's important, because you know the last thing you want to be worrying about when you're concentrating on the lecture is that your chairs uncomfortable or that your tables falling over*
>
> *QUT student*

Chairs that could be moved to suit the pedagogical practices used in various spaces were perceived by students to be good choices.

> *All the chairs are **moveable**, so if we're doing a lot of group work where you're asking your partner something, you know it's really easy to sort of **interact** with the people on either side of you. Having said that, they haven't bunched the computers together, they've kept it really nicely evenly **spaced**. It's also not a very large room. So you know it is something where, I suppose it doesn't get very noisy, but it's small enough that it does seem to promote that kind of discussion, whereas you could easily talk to people other side of the room. . So I've had some really great experiences in that room. And I've always liked it, regardless of my feeling of what the course was.*
>
> *QUT student*

Desk, tables and workspaces also received many comments from students regarding their suitability to enable productive work either within the formal teaching spaces or in the personal learning spaces. Size and flexibility were important issues.

> *.... I liked the desks. You had a whole table for each person and I think they were set up sort of, we had them set up in a U formation, and different tutors would just move it around how they want it, so it was **flexible** and it was like, ok, everyone break up into small groups, you could **move** the tables around and so. Which was really good, because then you can sit around the table and talk. Or we would have sort of a discussion format in the U format, so we were doing a debate or something and everyone could see each other in it and it worked really well.*
>
> *QUT student*

> *Normally the desks are arranged in sort of different sort of group positions, and you have that flexibility to move them all around and position yourself as you like. I think it makes it easier to see, and it makes it, it promotes **interaction**, you know, and when you're on the tiered, you know if you want to launch into the discussion, you're incredibly exposed; you've got to project so much more. In a small intimate space like this, it feels more like, you know, a casual conversation and it's less intimidating, and I just love that.*
>
> *QUT student*

Where desks were more permanent fixtures in the room, often students identified a clash with the pedagogical practices being attempted.

> *; it's one of those ones with staggered steps with rows of fixed desks, so you can't move any furniture around so it's really impossible for group work. And I was in a subject one semester where most of it was sort of run as like workshops and it was just the most impractical space for the lecturer to try and run like that and when it's staggered and you're trying to work in a group of 4 well it's too long to sit in a row of 4 and all talk to each other and then if you sort of turn your chairs around then two of you are sort of sitting higher, two of you are sitting lower, you can't actually sort of really look at the one document or talk at the same level and there's just no other space in the room for everyone to break off.*

QUT student

> *The desks are **moveable** so if you need to work in groups in the tutorial, you can move the desks around, and you can have a like a good one on one, and yeah you can participate. I find it easier to participate in smaller spaces. I feel more **comfortable** when it's a smaller space, you don't have to yell out*

QUT student

Flexible furniture was an important aspect for students in both formal and personal spaces. Fixed chairs did not have the capacity to adapt to the pedagogical practices that many academics wanted to develop with students or did not accommodate the diversity of student shapes and sizes for the development of good ergonomic work practices. The size and flexibility of desks and tables were also important to students. Large desks provided students with room for all their work equipment, flexible desks more readily facilitated group learning and interaction. Furniture comfort in learning spaces impacted significantly on the perceived affordance of the space for productive work and learning. I will leave a student to concisely summarise this view:

> *It's just you can't learn if the **acoustics** aren't good and the seating's not good. I do need **comfort** because if I'm fidgeting, I stop concentrating.*

QUT student

The colours, textures and patterns used in spaces are strongly associated by students with the appeal of the space. In general spaces that are colourful (walls, furniture etc) are perceived to be more appealing than spaces that are more utilitarian using functional, institutional colours that may be long lasting but not necessarily attractive. At some institutions where many of the buildings are concrete, a deliberate policy to reduce maintenance has been made to not use paint in these buildings and students commented on the appeal of these particular spaces. A student from QUT vividly describes the visual impact of learning spaces on the ability to learn:

> *In a way I think it's like, you hear people say, like on Master Chef for example, they say you eat with your eyes, well it's the same with this, if you come into a building, oh, I want to go in there. So with this it's the same, you learn too with your eyes.*

QUT student.

Learning spaces that are colourful, bright and~~,~~ dynamic are perceived by students as assisting them in the learning process. Feelings of alertness, interest, stimulation are associated with such spaces.

> *I like classrooms with **funky** designs or **bright** wall **colours**. It makes it a **fun** environment to learn in, wakes you up and makes you alert.*
>
> *ECU student*

> *.... there's a lot of space [...] it just felt very **light** and, I don't remember the **colour** of the walls whether they were sort of cream or white, but everything just seemed nice. It was just a nice feeling being in there.*
>
> *QUT student*

> ***Funky** colours and design makes it pleasant and interesting to work in. Library location means it's quiet. Nice enclosed and personal space for quiet group discussions, or silent study with friends.*
>
> *ECU student*

> *…the library that has all these brightly **coloured** furniture items and big tables that have power plugs and laptops and massive big computer screens. Yeah, I use it a lot. It's one of my most favoured spaces in QUT, it's really good.*
>
> *QUT student*

Conversely, the lack of colour also produces strong emotional responses from many students.

> *The lighting is horrible, the paint job is horrible. Well no matter what happens, it seems kind of dim and yellow, and yeah, the view out the window is really quite industrial as well.*
>
> *QUT student*

> *The concrete walls are ugly, the paint is ugly, its often dirty, The furniture is a mismatch of chairs from the last 15 years at least, its often broken, no one seems to maintain the furniture.*
>
> *QUT student*

The visual appeal of spaces is often ignored in the institutional context as not being an important consideration, however the group of students above clearly articulate how the appeal of a space is noticeably enhanced or reduced if this aspect of physical spaces is not considered carefully.

The last physical factor that was mentioned in students' photos consistently was the size of the space in which various learning activities occurred. Large lecture theatres that didn't manage the physical characteristics already discussed were perceived as alienating spaces, with little sense of connection between the lecturer or tutor and other students. Personal individual learning spaces for many students were small out of the way places that enabled them to work alone without close contact with other students. Personal group spaces on the other hand were often in spaces where the privacy of the group could be controlled – in specially provided rooms in the library or by the use

of screens like notice boards or in study booths or in more social spaces where the noise of the group would not be an issue. The size of the formal teaching space was also perceived to enable better interaction with both fellow students and academics as indicated below:

> *It was definitely a small space, and again, you know, fits probably about 20. The **acoustics** were fantastic.[...] in that space, we could always hear her, she was incredibly accessible and was able to move around and we did a lot of group work in our lectures generally.*
>
> *QUT student*

SPACES THAT ARE ACCESSIBLE AND AVAILABLE FOR A RANGE OF LEARNING ACTIVITIES

Student concepts of access that emerged from the data analysis were wide ranging in relation to both personal and formal learning spaces. This theme includes access as it relates to physical spaces - time of day and entrances to spaces, access to people, lecturers, other students and key support personnel, access to technological facilities, internet, computers, printers etc and access to facilities for more personal needs such as food, beverages etc.

In relation to formal teaching spaces access related to two aspects. Access to people and equipment within the learning spaces themselves or the more literal access such as physical entrances to formal lecture theatres. Three diverse, yet positive perspectives on the first notion of access are provided:

> *Other students with a positive attitude to learning and respecting others wish to study quietly and productively….Lecturer present to help and ensure the learning environment is positive…Equipment and **technology** available for use and support.*
>
> *CDU student*

> *What I like about it is the room is [ ] divided up into small square tables that fit 8 students, so it's predominantly small group activity utilised. You have central water access and gas and computers for lab work. It's very much based towards small groups, which is very good. But it also functions quite well as a teaching space, because then where I'm standing is actually the teaching podium that overlooks and is central to the room. So that's where your projector is and your white board and things like that, and everybody sort of sits around that.*
>
> *QUT student*

However not all formal spaces worked this well, as the following students describe. Discussions identified the value of computer and internet access in tutorials in facilitating group work and productivity by enabling students to access online information.

> *If you want to work on a **computer** while you are in a tutorial, you've either got to have a laptop or be in a computer lab. When you're in a tutorial, routinely, you do group based activities and that means that you do need a computer. It's not essential to use a computer, but it helps if you need an idea and you need to research something, it helps.*
>
> *QUT student*

> *And the tutor couldn't use Blackboard and you know the computer to show us anything to do with our assignment or anything. So that makes it very hard to learn.*
>
> *QUT student*

Access to spaces at the more mundane physical level centred on the appropriateness of the space and design of the entrances/exits. Some students had real issues about the provision of spaces that would facilitate their learning in a specific discipline area. Two contrasting examples from students exemplify the perceived student needs.

> *This is the one of the worst learning areas available to the Drama/Education students. They have to use this foyer area as a learning space during their studies [...] There is a shocking LACK of rehearsal/learning spaces for our rehearsals. This foyer area is where some of our rehearsals take place because there are limited room that are A)appropriate for rehearsing and B) and available for use.*
>
> *ECU student.*

> *....you've got a tutorial in the room, the whole front part of the room is computers and then the other half of the room there are big desks up the back and there's white boards, and you know, the overhead projector kind of thing. So pretty much I've had lots of tutes in the rooms where half of the work shop has been sitting down doing painting, or sketching or anything like that, and then the other half is scanning them into the computers and then working on it in the computer room, so you have access to all of those things in that one room where you've got enough room to spread. ...so you have access to different kinds of ways that you can learn in those sorts of rooms, because you can be sitting on the floor and chatting, and then you can go on individually work on a computer by yourself.*
>
> *QUT student*

The positive examples of access within formal learning spaces cited above demonstrate how access to a range of learning tools and technologies enables both academics and students to engage with a range of learning activities within the same space. These examples also reveal how students respond to spaces that allow them to flow easily from one type of activity to another within the same space, once again fostering the more temporal aspects of learning.

The second issue identified by students at one institution only was the external and entry points for some of the lecture theatres. They were critical of a lack of multiple external entrances and internal entrances as late arrivals could be very distracting. The design and layout of seating in these spaces

were also seen to be problematical as there was no convenient access for students, lecturers or tutors to move around in the space.

> *So you can't access the centre seats from the side. Unlike the other one in Z Block that had lots of entrances, this one you can't enter. It is like in the cinema, you have to go over people to get to your seat. An you don't see that well when it is not tiered*

QUT student

When discussing personal learning spaces, students perceived that the issues of access took on greater importance as this directly impacted on their work productivity and capacity to study. Lack of access to technology (computers, internet access, printers) and a lack of appropriate spaces for individual or group study was the cause of some frustration for students in the photo elicitation exercise. Lack of reliable internet access, power, computers and convenient group spaces were all cited by students as issues. However the resourcefulness of some students is to be admired as this student demonstrates:

> *Well most people, they don't check the power plug, so if you turn that off they won't know, because I found one of the computers like that, and the power point was actually connected out and I was there for a while thinking about it and I'm like, I can't find any reason that this computer won't work so I started to look at the back and I found the plug was taken out, and I was like, oh that's a really good way to ensure you always have a computer, because I know most people would never figure to check the back.*

QUT student

A final aspect of access in the learning landscape of universities is access to social spaces. Places to gather and mix with friends, eat and drink or just chill out. These type of spaces featured significantly in the photo elicitation study at all institutions and it's important to recognise that they are an inherent part of the learning activities of students, as is attendance at lectures. This is succinctly put by a student at ECU when discussing a positive place for learning: the tennis courts!

> *I have used these courts on many occasions mainly for the tennis courts. Myself and friends play here on a regular basis. Playing tennis I find has many benefits with being able to focus when studying or just a general stress relief and having* ***fun****!*

ECU student

SPACES THAT ARE EASY TO USE AND ADAPT WITH APPROPRIATE TECHNOLOGY AVAILABLE.

The final theme that resonated for students surrounds the ease of use and adaptation of spaces to suit personal needs. Concepts in this area included laptop, computer, wireless internet, whiteboards, power, maintenance, cleanliness and spaciousness. While many of the concepts in this area are strongly associated with the personal learning landscapes of students, many of issues are also applicable to the more formal teaching spaces. The following student excerpts discussing their favourite personal learning spaces, provide an overview of the ease of use concept. What's

interesting to think about is how relevant this 'ease of use' notion will be for the more formal learning spaces as we progress into the 21st Century.

> *It's just very easy to use; everything is in close **proximity** ...., so you've got easy access to the printer, the photocopier and those kind of things. There's never a queue for them. The desk space that you have for yourself is ample, so you can spread things out. And you know what it's like when you've got books and papers; you want that space, it's really important to spread out... You're hooked up to the internet, so you've got all the online resources that you want and for me it's just a really great place, I've had a lot of productive work done there.*
>
> *QUT student*

The 'ease of use' concept applied to more formal spaces is associated with the utility of equipment e.g. computers, internet access, data projectors, clarity of screen projection, size of screen, and microphones and its flexibility in enabling the tutor or lecturer to move around the space and engage the audience. The following text extracts highlights the range of considerations.

> *This is the best place to participate in a tute. ... I like it because there's all the technology you need. You can use projectors and I think you can record, or maybe you can't. But it's got nice big screens and the computers and so you can actually access the internet and do all that stuff and get the information if you need to use. A lecturer can, or a tutor can stand somewhere in the room and actually deliver a tutorial or if you need to do active learning things or get together in a group, the space is conducive for that as well. Like I was saying just in here, you can huddle together around that semi circle and work in a group quite well together. But if you're just being delivered content, you can still just sit back on your tail and see your lecturer or your tutor.*
>
> *QUT student*

> *It's a nice space to learn in and you know the microphones never fail. It's got a projector, it's got a whiteboard, and it's got everything you need there to turn that instantly into a tutorial room.*
>
> *QUT student*

While most associated ease of use of tutorial and lecture spaces with the provision of computers and data projectors, there was surprise that spaces were not also equipped with whiteboards. This was another aspect that contributed to notions of ease of use for both students personal and formal learning activities.

> *…it doesn't have a white board, and there've been so many lecturers that are like, they turn around and, oh, there's no white board here. They sort of come with pens and things. And so you really feel you're missing out if they were actually going to write something, you know diagram and things up*
>
> *QUT student*

> *Yeah and you can write up on the whiteboards and lots of tutes I've been in as well we've stuck up our posters on the walls and you've got enough room.*
>
> *QUT student*

The provision of movable whiteboards in students' personal learning spaces provided a number of ease of use options for students when working in group situations. They were used to simply communicate the ideas of the group which could be photographed for later use by all, or more creatively to close off an area to ensure that there were no distractions from other students passing by, thus enabling the group to be more productive.

> *Group study spaces are ideal for group discussions: Isolated and **comfortable** for group interaction. The study area has a whiteboard on which group members can **communicate** / **explain** their ideas*
>
> *ECU student*

Ease of use was also associated by students with the availability and reliability of computers and equipment (printers, scanners) in communal computer labs, and less so in the formal learning spaces. As there are limited computers available, some participants expressed anger about what they perceived as unproductive use of the limited computers, expressing annoyance that limited computer resources were being used by students for social purposes.

> *This student is playing games on the **computer** and that is very distracting to people who are sitting near him.*
>
> *CDU Student*

The availability of computers was overcome for some students by bringing their laptops to campus, but a range of ease of use issues were associated with this activity, including reliable and efficient wireless internet access and limited availability of power points to recharge batteries. Two illustrations of positive student experiences are provided below:

> *If a student wants to work with his **laptop** simultaneously when the lecture is going on, then this room is very good for that. It's like the signals are very proper.*
>
> *QUT Student*

> *Nice big desks, Power Points for the laptop and great open views. No passers-by or household objects to distract us either.*
>
> *ECU Student*

Crowded spaces, with inappropriately sized furniture, poorly maintained or just plain dirty also impacted on ease of use for students. In formal and personal learning spaces the complaints and the compliments were very specific:

> *This room is too small for our class – gets too squishy with too many people*
>
> *CDU student*

> *The table takes up the vast majority of the room and there's very little movement for the chairs anyway to arrange yourself to, I'm a walk talker usually, you can't do that. So it feels crowded, have a look at how low the ceilings are*
>
> *QUT student*

> *This is a very good learning space. It is **spacious**, **tidy** and very **clean**,*
>
> *CDU student*

Issues regarding maintenance of spaces and equipment prompted students to respond very emotively. They expressed both frustration and anger regarding perceptions that spaces and facilities are not adequately maintained, cleaned, serviced and updated. Students recognised a difference in the standard of maintenance between spaces, and where possible chose to work in spaces that were better maintained. Cleanliness was an important theme in the discussion of personal and formal learning spaces as the CDU student indicated above.

> *I suppose the other reasons that I sort of liked it, is that it's really well **maintained**. So the computers seem to be, you know if there's any technical issues, they obviously get sorted out. And that's not just the computers, but the printers as well. So they've always got paper in them and they're not, you know, going crazy all the time. The furniture is **clean** and it actually appears to be cleaned on a regular basis.*
>
> *QUT student*

> *The toilets are really **close** and it's **clean**. It's really quiet and there's always computers available.*
>
> *QUT student*

When considering learning spaces for students, while its important to refurbish and update older classrooms to enable more active and connected learning pedagogies to occur, it's also important to understand that students don't see their experience at universities as a series of disconnected lecture and tutorial spaces, but a learning environment that facilitates the formal, the personal learning as individuals or members of a group, and the social. So the broader notion of 'place' is possibly a more useful concept to consider in this overall scheme as well as the more specific themes of access, ease of use and quality space experiences. These help empower students to become more productive, and focused learners according to their perceptions. The student perspectives are summarized in rich picture form in Figure 3 below.

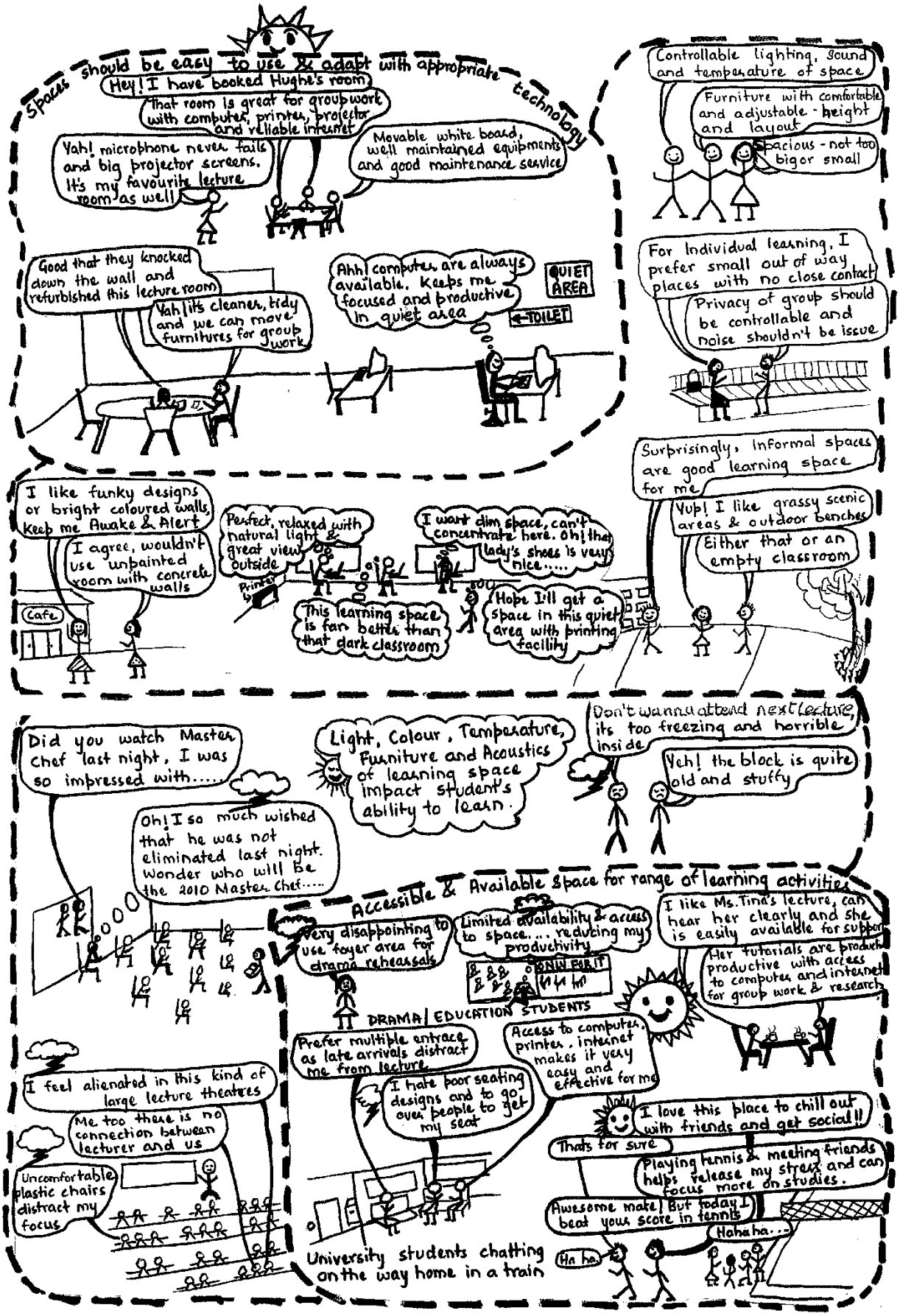

FIGURE 3 - RICH PICTURE REPRESENTATION OF STUDENT PERSPECTIVES OF LEARNING SPACES

THE ACADEMIC PERSPECTIVE

Academics, while not necessarily the biggest users of university learning spaces, are perhaps the group most likely to be impacted by the quality of the spaces in which they teach. While it has long been recognised that good teaching based on good curriculum design can triumph in every the most ordinary of spaces, the affordances offered by various spaces do tend to have an impact of how academics perceive what might be possible in their classrooms. Academics spend large parts of their academic week in a range of different lecture theatres, tutorial rooms, laboratories (both computing and scientific) and performance spaces, as well as all the spaces in between. Clearly, the way the academic perceives the affordances offered by a space, can either impede or assist the academic in their ability to imagine new ways of teaching and either support or constrain any move towards more peer based or active forms of learning. As one senior academic put it:

> *I think our current spaces get in [the] road because they don't offer anything to the **imagination** of the teacher. I mean, I think a good teacher in a bad space will just forget the space and get on with something that is **engaging**. ... But for someone who's struggling or new or hasn't really thought about it a lot, if that person is presented with the kind of space that doesn't offer an **alternative** way of doing something. The default setting would be to would be to stand and talk, and that will inevitably turn into a lecture and then, you know – it all goes to hell in a hand basket from there.*
>
> *Associate Professor, Built Environment and Engineering, QUT*

As the second of the three key community members (people) in the learning spaces framework, it is important then that we consider which design principles are most likely to appeal to academics.

To facilitate this consideration, 30 academics were interviewed from both Charles Darwin University and Queensland University of Technology. The academics were purposively selected based on their level of activity engagement in the current learning spaces debate at each institution. Academics interviewed ranged from tutors to professors covering a range of different disciplines including education, engineering, information technology, library sciences, creative industries, indigenous studies, academic literacies and nursing. While not exhaustive, it was anticipated that the range of disciplines included would help avoids any possible prejudicing of preferred design principles.

Semi structured interviews were conducted lasting between 30 minutes and one hour. All interviews were recorded on video camera and later transcribed. The transcripts were analysed using Leximancer text analytics software to identify common terms and concepts and to discover key themes associated with learning space design. All transcripts were automatically analysed with the thesaurus and concept seeding based on the concepts generated from the literature derived learning space principles identified in chapter 2.

The analysis broadly identified a range of themes and concepts associated with notions of flexible spaces that support higher levels of student engagement with learning activities, spaces that support both individual reflection and group collaboration, spaces that are emotionally physically and culturally safe, spaces that break out of the current 'battleship grey' or hospital beige' approach to colour, spaces that are bright, comfortable and have plenty of natural light and spaces that provide for easy access to obvious human comforts like coffee and food.

Based on a straight frequency count the more popular principles in the mind of academics include learning, flexible, engaging, technology, collaborative, space, students, colour, social, dynamic, comfortable, coffee, natural, wireless, group, people, support, light, mobile and interactive. Figure 4 below presents a more detailed word cloud drawn from a summary of the most commonly found words in academic transcripts regarding desirable learning spaces characteristics.

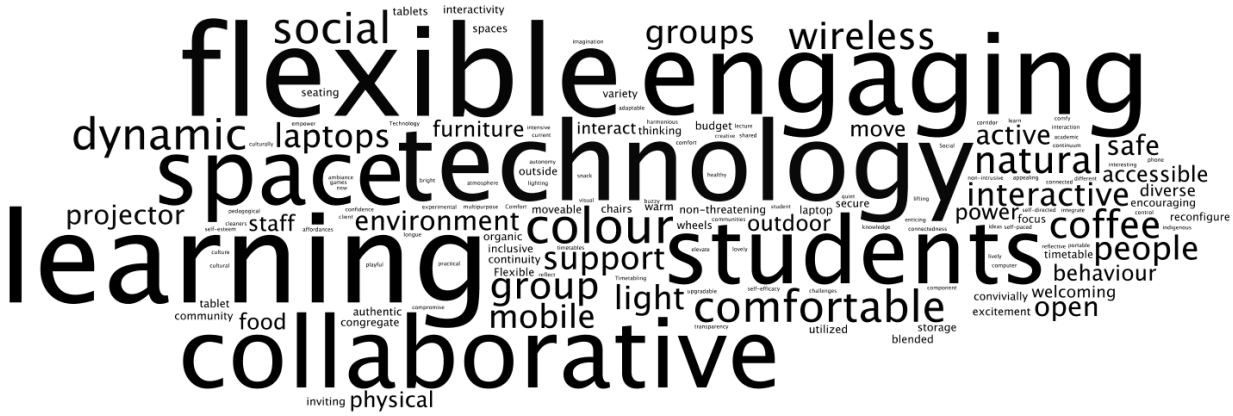

FIGURE 4: DESIRABLE CHARACTERISTICS OF LEARNING SPACES FROM THE ACADEMIC PERSPECTIVE

When the concepts are considered in more detail, five basic themes emerge:

- Spaces must first and foremost help engage students and support a range of different learning activities.
- Spaces should help ensure a quality learning experience.
- Spaces must be accessible and safe, both physically and psychologically.
- Spaces should be easy to use and integrate well with related spaces.
- Spaces should be supported by appropriate technology.

Each of these themes will be explored in more detail in the following sections predominantly using the voice of the academics to help explain what they imagine would constitute a good learning space. Extracts from transcripts are shown indented to clearly distinguish between actual academic views and our interpretations of those views. Modifications, shown in square brackets, are made only to aid the clarity of the various comments.

SPACES THAT ENGAGE LEARNERS AND SUPPORT A RANGE OF LEARNERS AND LEARNING ACTIVITIES.

One of the most common themes amongst most academics interviewed is the desire for spaces to be flexible enough to support a range of different learning activities. Indeed the top two words by frequency are learning and flexible. However, it is important to note that flexibility can mean different things to different people.

At the simplest level, flexibility can mean supporting a range of different learning activities within one class

> *I would say a better word is [it] needs to be **flexible**, which actually means it needs to be dynamic, it needs to be able to be changed according to the needs of current class, also according to what is actually happening in the class at the*

> *time, so I would say that the **dynamic** [aspects is] probably the most important thing, particularly in the format that I teach here.*
>
> *Lecturer, Information Technology, CDU*

At another level, flexibility can mean supporting a range of individual and group based learning activities across the day, the week, the semester and across the year based on the differing needs of a diverse range of learners

> *I would say that a good learning space is one that's **dynamic**, that's **organic**; that would change with the differing needs of the learning community that's using that learning space.*
>
> *Associate Professor Information Systems QUT*

Flexibility might also mean being able to respond to a diverse range of different users or learners in the university community

> *The projects that are happening across the Creative Industries are quite diverse and they support students from a range of disciplines. We have about eleven disciplines in our faculty. So the projects are quite **diverse**... [the students are] going to need to be able to manage that project effectively and the space is going to need to be quite **flexible** for each of the different projects to work in there.*
>
> *Senior Lecturer, Creative Industries, QUT*

Enabling flexibility clearly requires attention to all the elements in and around the learning space - the space itself as well as the technology and the furniture in the space

> *Probably what I'm looking for is furniture that is sort of non-intrusive that we can move around, that we can make work for us, that allows a lot of **social** interaction, a lot of group learning.*
>
> *Associate Professor, Information Systems, QUT*

> *so what you're looking for in terms of a learning space is for such delivery of programs is you're looking for a lot of **flexibility** in terms of the physical space, as well as a lot of **flexibility** in terms of the types of technology you would use, so collaborative technologies, generally, what would be ideal in this kind of space.*
>
> *Tutor and Learning Designer, Built Environment and Engineering, QUT*

Enabling flexibility also requires clear and explicit permission to be provided to support academics who want to be able to use spaces in the way they were designed

> *The other hassle thing is the only space in the university where you actually allow moving the furniture without to get in trouble for not leaving the room, so timetabling in that sense is an issue, I mean obviously, I think this is the normal issue trying to get sessions fit into time is hard how we deliver.*
>
> *Senior Lecturer, Information Technology, CDU*

Considering this widespread focus on the need to make spaces flexible, it might be easily be assumed that this should be one of the key principles for retrofitting or redesigning spaces. However, some academics have cautioned that flexibility is not always what it appears to be. Some suggest that while a space might be deemed to be flexible in that it can be reconfigured, the salient question is actually can the academic and the students easily undertake the task in ways that don't impede on the learning activities being undertaken?

> *I think **flexible** is one of those words that gets over-used. I think a space should be **agile**. It should be **agile** enough for us to do the kind of things that we want to do in those spaces, without having to do major reconstruction work to make it happen. To explain the difference, I guess I think of it this way: if you go to a conference centre or a hotel room, they have those big dividing walls and that makes the space **flexible**; because you can open it up. You can make it a small space or a big space but, if you've ever tried to move those walls, you have to bring in specialist people to shift the things, to unlock the things, to push them back. It's not agile. You can't actually do that in the kind of timeframe that a class needs to make it happen*
>
> *Senior Lecturer, Information Technology, QUT*

Given this cautionary note, it is important that learning space design principles clearly articulate what form of flexibility is intended, desired and possible so that time, money and effort is not spent on enabling forms of flexibility that are ineffective.

Another point of interest in many academic comments is the common association between a space being flexible and the notion of a space being dynamic. However, dynamic, like flexible, is used in a variety of different ways. As we have already seen, dynamic as the term pertains to motion might mean a learning space that is easily changeable. Dynamic in the sense of something that is vigorous, active or energetic might also mean learning spaces that help support active rather than passive forms of learning

> *It's more about that it's a place that encourages people to interact and so it's probably noisy. It's populated. It gets messy. It's **dynamic** – comes and goes and people shift in and out. So it's got a life. The place is lively.*
>
> *Associate Professor, Built Environment and Engineering, QUT*

Dynamic can also be associated with the notion of creating spaces that help student engage with their learning

> *this is a really hard question for me to through, it has to be a space [that] **stimulates**, it needs to be a space for students come in and feel like they have to learn, there is the purpose, it needs to be **engaging**,*
>
> *Lecturer, Engineering and Information Technology, CDU*

One of the key notions associated with a dynamic space from the perspective of many of the academics interviewed is founded in the view that academics and students should be engaged in an active learning process as partners

> *I think it probably might make it a lot more **dynamic** in the sense that it's not the teacher being in control, being the sage on the stage as it were. That it allows the students to really take full control and be **interactive** and **engage** with what's going on in the learning context – whatever it is – whether it's a lecture or a tute, or whatever.*
>
> *Associate Professor, Information Systems, QUT*

> *I think you need space where's there's opportunity for active **engagement**; and that really means opportunities for people to talk to each other, to share problem solving tasks, to have time to reflect on the task they're involved with, to ask questions. So it's really about giving a degree of autonomy and I guess **empower** students to focus on the tasks that they're learning, rather than to be sitting there listening to an academic drone on.*
>
> *Associate Professor, Education, QUT*

As a consequence many academics argue that learning spaces should avoid reinforcing academic control of the learning activity through design elements such as fixed podiums and seating that reinforce artificial separation of academics and students

> *The one environment that I've been pushing for – and haven't had much luck so far – is to have a classroom without the four walls. What I mean by that is that there doesn't have to be a front to the classroom. You may have LCD screens on four corners of the room where students can just work in groups in different corners of the room. The lecturer can just walk around with a tablet and teach to the group, or share ideas with different groups.*
>
> *Professor, Education, QUT*

It is probably worth noting at this stage (without necessarily addressing it), that this sort of view is often the one most at odds with the broader academic population and often the defining characteristic of academics actively engaged in the learning spaces debate. This dichotomy is one that needs to be addressed less so in the design of learning spaces and more so through the appropriate development of academic staff capabilities.

SPACES THAT HELP THE QUALITY OF THE LEARNING EXPERIENCE

As we have already seen from the student perspective, the question of comfort is an important consideration in the learning space equation. Like students, academics express views of learning spaces that suggest that the need to 'feel comfortable' is a necessary precursor to any form of serious engagement in learning activities. In many cases the negative form of the argument makes the case even clearer – students who are uncomfortable are focused on their discomfort rather than the intended learning activity. Like Maslow's hierarchy of needs, learning spaces need to address the physiological needs of the users before any higher order activities can occur.

Like flexibility, comfort can take many forms. Perhaps some of the most common complaints associated with learning spaces is the quality of the furnishings, in particular the chairs. Even with more active forms of learning, students (and academics) often spend considerable time either sitting

on more formal chairs or on less formal soft furnishings. Either way the comfort of this element is clearly at the forefront of many academics concerns:

> *we have always done the teaching in the seminar room, and probably the favourite room in the university for many people, and the thing I like about it is the **comfortable** chairs and carpet, so people can sit on the floor, it's **comfortable***
>
> *Associate Professor, Education, CDU*

> *I had to teach a classroom where the different types of seating, you can see straight away that those three chairs the **comfy** ones let us try to get them first, or with different chairs, for example, tables and chairs are in different **colours**, they look different, they don't look like more in up-to-date, looks like proper classroom, it **distracts** the whole environment, and they don't feel comfortable in that environment, so having nice, clean, relatively new furniture, and the very comfortable chairs, comfortable environment for me is really important.*
>
> *Lecturer, Information Technology, CDU*

Another common concern is associated with the lack of light (mostly natural light) or fresh air in many learning spaces. For many academics the questions of natural light and the availability of fresh air is related to students ability to continue to engage with classroom activities over any lengthy period of time

> *one of the first priorities is to have a light area space, and that includes lots of **natural light**, preferably with windows for example, that can open up, but as long as there is natural light come in, I find that with unnatural light, students tend to get very tired, they lose interest quickly, and short break outside, some **fresh air** would stimulate them, so that is the main one*
>
> *Lecturer, Information Technology, CDU*

> *So good **air flow** obviously, that's really important here, that would happen with my windows, and of course I would like a kitchen set up which allow me to have health sustainment during the breaks, and for to be a part of the invitation for students to come to the space, and feel **warm**, **comfortable**, **safe**, etc.*
>
> *Lecturer, Academic Literacy, CDU*

It is worth noting that academics are generally not arguing for all natural light and fresh air, noting instead that there needs to be a range of natural and variable light and fresh and augmented air options, depending on the external conditions

> *well, first of all, it's [a] tropical area, it must be a **comfortable** environment, ...some talk about whether we should have open area teaching up here, but thanks for 6 months that will be great, and another 6 months that will be terrible,*
>
> *Lecturer, Engineering and Information Technology, CDU*

The issue of light and comfort is often associated with notions of learning spaces being bright and welcoming. Another set of views strongly related to lighting is colour

> *I would go as far as saying, even the **colour** of the carpet and the walls – to make it **warm** and **inviting** for students to just really be **engaging** in their learning in a space that they feel very **comfortable** in.*
>
> *Professor, Education, QUT*

For many academics the colour of the learning space conveys a strong sense of what is expected in terms of desirable behaviours in the learning space

> *it's easy to talk about what you don't like, this building has a battle shape grey walls, and I find that quite depressing and quite hashed for flow inside the lighting, you don't walk in and feel **comfortable**.*
>
> *Lecturer, Engineering and Information Technology, CDU*

> *So, the spaces need to be something that actually encourages you to get involved in the **learning** process, whereas most of our learning spaces are beige, they encourage me to go to sleep. They make me think about hospital wards, where what we're really trying to encourage people is to be quiet.*
>
> *Senior Lecturer, Information Technology, QUT*

This notion of stimulating students through the use of colour is one that many academics recognise as being difficult in that no one size suits all and that needs can easily change over time

> *A lot of work had been done on the **colour** and lighting, and I wouldn't call myself an expert in that but, I know the people have looked at learning styles have mapped the types of light and time of day and all those sort of things.*
>
> *Associate Professor, Education, QUT*

Some recognise that the over use of colour can easily act to distract students rather than stimulate them

> *So they need to be **engaging**, and I don't mean just have bright colours, I mean they just need to be engaging.*
>
> *Senior Lecturer, Information Technology, QUT*

> *Well, the **vibrant** I think I mentioned too. It's not about: it's got to be orange. ...So it's got a life. The place is lively. Welcoming, I think is about being able to behave normally.*
>
> *Associate Professor, Built Environment and Engineering, QUT*

For some academics the question of encouraging students to engage and focus in the classroom is not so much about what goes on in the inside but what goes on outside. Insufficient acoustic treatment to block out external activities is another of the more common complaints levelled at some learning spaces.

> *I feel the students need a environment where they can not necessarily be able to distracted, they need be able to **focus** and **engage** with what's going on in the classroom*
>
> *Lecturer, Engineering and Information Technology, CDU*

> *What have to be **comfortable** and vetted from noisy areas like car park full of traffic,*
>
> *Lecturer, Academic Literacy, CDU*

Another area where the issue of comfort has more to do with what is outside or adjacent to the learning space is the somewhat vexed question of access to comfort elements including food and beverage. Students are increasingly involved in learning activities that take place over long periods or occur in the evenings and on weekends. For this reason it is important to recognise their need to access adequate sustenance to ensure they have the mental capacity to continue their engagement with the learning activity underway. While this can be met in part by on campus cafes and restaurants, access to these resources outside normal hours also needs to be considered. Many academics have argued that small kitchenette facilities spread across clusters of learning spaces will enable students to make coffee or heat food during breaks in class activities and return refreshed to the learning activity

> *Also I find when I'm a student, I'm studying, if I tend to get my **energy** levels a little bit low, if I'm studying from home or any other places, then coffee helps me, and rather than taking a break, people wants to take their breaks at the different time, so having a small area with a kitchenette where you can make yourself a cup of coffee, or get a glass of water, or even a fridge where you can put your healthy snacks, people can bring their own snack foods, you know that will keep them going, rather than having to you know waiting for a period when the lecturer is ready for a break, then everyone goes out.*
>
> *Lecturer, Information Technology, CDU*

> *It would probably also need to have some issues around, I guess, Health and Safety related to food, because, you know, it may sound a very trivial thing but, having access to a coffee or sandwich or something like that, if you've got people working for hours on end, I think contributes to probably a **harmonious** environment. So the environment – you can look at the environment physically but, there's also a kind of **social** environment that you're building up and those two factors tend to interact. There's got to be support for the learning. There's got to be support for a comfort zone where people can work.*
>
> *Associate Professor, Education, QUT*

It is clear from the level of academic concern that the question of comfort, both physical and physiological, needs to be carefully considered in the design of any new learning space. While easy to articulate, these requirements are often actively avoided by learning space implementers for a range of costs and maintenance issues. What is needed is a common view about what might be easily facilitated in the design or new learning spaces.

SPACES THAT ARE ACCESSIBLE AND SAFE, BOTH PHYSICALLY AND PSYCHOLOGICALLY

Beyond the physical need for comfort, many academics argue that learning spaces also need to be psychologically comfortable for a wide range of different users. Some academics interviewed suggest that like the basic need for comfort, student engagement in higher order learning will only be facilitated when learners are free from any concerns about their physical safety and where they feel welcome and included.

Sometimes this issue of safety can be easily addressed, as is the case with physical safety

> *it's easily **accessible**, students don't need to walk [in the] dark to be able to find the lecture,*
>
> *Lecturer, Information Technology, CDU*

In other cases a more comprehensive approach is needed, particularly when is relates to making students feel included, something which can be more esoteric

> *It would probably need to be one that's non-threatening; that's **inclusive**; that people who are using that learning space feel it's actually something they can use to meet their needs.*
>
> *Associate Professor, Information Systems, QUT*

The question of creating a safe and inclusive environment also needs to ensure learners and academics consider their role in the global community and aid the discovery and development of a broader sense of cultural awareness in students. As universities welcome more international students and enact a greater commitment to the welfare of indigenous students, this question of cultural inclusion and safety is one that is important to many academics

> *obviously the notion of the **cultural** components in providing the culture **safety**, and I suppose not in terms of contents, but in terms of experience that I'm trying to get them to do working together, for people who get different background, like engineers and IT people seems have particular difficult time to trying to make sense about this kind of staff, so I figure if we work as groups solving the problems if you like, get varieties of different perspectives, the things flow through all the time, so if you're working in groups, and you don't suffer in a group, the you get exploded in different people's opinions, that you haven't negotiate and deal with that.*
>
> *Senior Lecturer, Indigenous Studies, CDU*

While the question of cultural, emotional and physical safety is complicated enough, it is further compounded when the question of inclusion is considered. A number of academics interviewed spoke about inclusion not only in terms of a sense of belonging but also in terms of a right to participate actively in the learning process

> *so it's **inclusive**, so they can think, "yes, I can be here, and I should be here and I have what it takes to be here".*
>
> *Associate Professor, Information Systems, QUT*

Some academics indicated that if students are to be truly encouraged to actively participate in their learning then they need to be made feel comfortable at all levels to the point where it is clear that it is not only acceptable to challenge academics but also encouraged

> *It's the **ambience** of the place I think that's important; feeling **comfortable**, and particularly for people who have some anxiety in that topic area; that this is a **safe** place to be physically and also psychologically in the sense that there's not an elevation of the academic or lecturer on a podium. The lecturer is almost invisible in the room, they are able to move around flexibly and talk to people and challenge people and be able to sit down and [scaffold] learning in a sort of not obvious way.*
>
> *Associate Professor, Education, QUT*

Like the question of academic control of learning, the concept of being able to openly challenge academics is not necessarily one widely accepted by the broader academic population. Although the issue has more to do with the wider education environment of the university, aspects of learning space design can and do play an important role in conveying or discouraging inclusiveness. These design elements extend beyond the symbolism of the podium and the front of the classroom to include the level of social accessibility and serendipitous interaction between academics and students encouraged and supported across the wider campus.

SPACES THAT ARE EASY TO USE AND INTEGRATE WELL WITH RELATED SPACES

Many of the academics interviewed expressed a desire for spaces to be easy to use and for the intended use of a space, furniture or technology in a space to be self evident to users and requiring minimal specialist training to utilise. While many universities have support services that can respond rapidly to problems in learning spaces to avoid major interruption to any learning activity it is important that the design elements in any space are easy to identify and use as intended

> *So I think there's a lot of confusion between what in the architectural profession we'd call architectural determinism, which is we know that spaces do not determine behaviour. They will afford certain types of behaviour as opposed to others. So if you really want group behaviour, even in a rigid lecture theatre, you will still make it happen. Not easily but, you will still do it. Obviously a space that affords the ease of that is a better one*
>
> *Associate Professor, Information Technology, QUT*

In terms of ease of use many academics interviewed made particular reference to the technology that is used in most learning spaces. As something that changes regularly and often, technology is obviously a key learning space element that academics would like to see as easy as possible to utilise

> *it needs to be the technology that's accessible, using a [flip] camera is, you know plug it, do it, and that's all you need, you don't need to think about sort of issues of you know, have I got the right software, so I need to download this, have I got the wrong wires, you know that sort of staff, sometimes makes technology complicated, that what I mean by* ***accessible****, something that is* ***easy to use****, it doesn't need to think about the technology,*
>
> *Senior Lecturer, Indigenous Studies, CDU*

> *When that happens in a learning space where everything seems quite* ***seamless*** *and technology is easy to use, to access, to distribute to the students, then I think students will take away a very positive learning experience with them.*
>
> *Professor, Education, QUT*

One particular concern associated with ease of use is a consequence of a move away from learning just occurring during the dominant two hour lecture, one hour tutorial or one hour workshop model to more intensive, mobile models of learning. A number of academics interviewed see the future of learning as involving more intensive, mobile models of learning because they allow for greater levels of engagement by the student

> *I'm also very strongly in favour of* ***intensive*** *mode teaching, because I think you get more things happening there if you get that sort of cauldron. Whereas this 'come along for an hour, go away again, I'll see you next week' is really no recipe for* ***engagement****.*
>
> *Associate Professor, Information Technology, QUT*

Others suggest that even with more traditional modes of teaching and learning, a lot of student engagement with learning happens in more social contexts outside the formal classroom

> *Make sure that you're creating environments that can be* ***flexible*** *and open to new opportunity. Don't assume that the learning is going to happen within a 25 student classroom, or a 300 student lecture theatre. That the spaces have lots of opportunity for outside the classroom* ***collaboration*** *and that the social spaces are also learning spaces. So, really think about the* ***social*** *spaces and the ways they can be best used to enhance and support learning as well.*
>
> *Senior Lecturer, Creative Industries, QUT*

> *I like that lounge space to break out the formal areas, that sort of in between ..., it's relaxation, comfort.* ***Socialisation****, I think it's opportunity for people just to talk [in]formally.*
>
> *Associate Professor, Nursing, CDU*

If learning spaces are going to be able to accommodate these forms of learning activity then there is a need to think of them as a connected set of spaces rather than a collection of independent rooms

> *facilities [need to be] close to each other, ..., when I'm saying that, they have the classrooms including the computer labs next to each other, and it's not the*

> *building you have to send your students out to another building to have lecture, and another one for computer class,*
>
> *Lecturer, Information Technology, CDU*

It also requires that the concept of learning spaces is expanded to include corridors and hallways, social spaces like coffee shops and gardens

> *I have also encouraged that, by giving my staff the ideas about continuity of space, where they conduct an activity in the classroom formally and then having the activities go outside into the corridor space and even out to the open spaces outside, with all our wireless set ups it is now possible for our students to do that. Students go out in groups with their digital cameras and video cameras and laptops; and they actually continue their work outside in open spaces; on the grass, in the courtyard.*
>
> *Professor Education, QUT*

It is worth noting that simply saying that a coffee shop is a learning space does not make it so. While students often have access to a reasonable array of mobile technology, the same is not true for most academics. One senior academic argues that if academic staff are to be engaged in a learning partnership and model learning outside the classroom, then an important precursor is making sure that they have suitable mobile technology.

> *Also, in terms of policy as well, I think we need to be **flexible** enough to cater for these changes. And I for one always support my staff, because I will buy them the **mobile** technology and I will get them the software or the equipment that they need; because if you don't then they are not being encouraged to adopt a different way of delivering their teaching or to even try to engage the students*
>
> *Professor Education, QUT*

Equally, simply co-locating classrooms together doesn't make a learning precinct. Many academics make reference to frustrations associated with not actually be able to access available spaces, either because of security requirements or timetabling concerns or because of university procedures

> *The other problem here too, and maybe a worldwide problem is the security, but if you are in a room, and there are four empty tutorial rooms next door to you, so you want to spread your class out, put them in group, and have them all come back, there is no one using that space, but you can't, because it's locked, it's not timetabled or booked,*
>
> *Lecturer, Academic Literacy, CDU*

> *It was raining, so we couldn't work in the Botanic Gardens, so we came over to the courtyard...but the space under the building there in D Block ... it's bookable, apparently. So I rang up and someone, did some paperwork, and we used it. Anyway, the next day I got an email back saying I didn't have permission to use the space, because I hadn't applied seven days before. So, someone responded within less than twenty-four hours to say, "No, because you must apply seven days in advance." Now, there are probably good reasons. I don't know what*

> *they are; maybe it's running with scissors or something ... But, it's absurd. So, because it's raining, we can't use this. And what do we do: cancel the classes, because they have to have seven days notice if I want to use the under croft in D Block? And the fact that they responded so quickly to say, "No, you have to do it in seven days" suggests to me that there's not a process that takes seven days for whatever to get through to somebody. It doesn't, obviously.*
>
> *Associate Professor, Information Technology, QUT*

Here we see clear evidence of the need to align university procedures with changing practices in teaching and learning. When learning spaces are largely considered to be a collection of single rooms and learning takes placed in defined blocks of time, support procedures like security and timetabling work well. When the use of learning spaces becomes more ad hoc and less predictable then current practices tend to be found wanting.

SPACES THAT ARE SUPPORTED BY APPROPRIATE TECHNOLOGY

For many academics technology is a key element of most learning space, but technology for technology's sake is something that should be avoided

> *I think the appropriate **technology**, and also training in the appropriate technology, but not to get carried away [with] technology.*
>
> *Associate Professor, Nursing, CDU*

Useful technology focuses on enhancing learning and supporting the social and interactive nature of modern pedagogies. Useable technology should be unobtrusive, mobile, and in the words of some academics- *just there when you need it*

> *...and the same as the **technology** perhaps, it allows me to be able to move my tablet PC wherever I want to go, so when I need them, they are there, but they are not. The most important aspect when you walk in the door, there is the technology.*
>
> *Lecturer, Academic Literacy, CDU*

In many ways the desire to use technology in learning spaces is driven by academic views of students as being technology rich and influenced by a whole new generation of interactive, social and visual environments in their personal lives

> *What] I would like is a space that would allow me to use **technology** widely, because I think our learners now are much more **visual** learners, they're used to YouTube, Twitter whatever,Facebook, I asked a question recently, I said who's on Facebook, and almost every hand raised up, I think students spend probably much more looking at visual learning aid than my generation who rely on, what's most available is print material, I think the time is moving on, and we have to move on with that.*
>
> *Senior Lecturer, Health and Science, CDU*

For some academics there is a perceived obligation to use technology so that we can better prepare students for their professional lives in a digital world

> *Yes, and so it's about thinking further about what is the university's responsibility to provide and how can we also provide students with ways of thinking about their **digital** life and their digital materials and their digital identity. And **empowering** them to think about how they want to move forward and work into the future as professionals. And I think that's more our role rather than thinking that we need to supply everything for them while they're here. We're probably supplying them with the capacity to continue into their life as technology literate, digitally **literate** professionals*
>
> *Senior Lecturer, Creative Industries, QUT*

This perception is enhanced for some academics by observations of increasing levels of student provisioned technology including, laptops, mobile phones and tablets

> *The thing is, what I have certainly found in IT in the last three to five years is a growing number of students bring in their own **laptops** anyway. They go into a PC lab they've got the desktop there and they put their laptop beside them and they actually use their laptop rather than the desktop*
>
> *Associate Professor, Information Technology, QUT*

However, while some are already pronouncing the death of university computer labs, students are far from a homogenous grouping and access to technology varies widely depending on various demographics

> *I think you go to some universities, you probably find a lot of school leavers, and they've got that **technology**, but we've got a lot of people who come from, you know, I suppose there are some minority groups, different cultural groups in low social economic backgrounds, so there is a need to provide, if we want to use it, there is a need to provide for the large chunk, so in the class today, when there are 45 people there, I think only three that have their own machines.*
>
> *Senior Lecturer, Indigenous Studies, CDU*

Nonetheless, in an environment where technology is constantly changing, institutions cannot hope to ever supply all the solutions, systems and hardware that academics and students might want to use in their learning activities. It is worth noting that student provisioned technology doesn't mean universities can simply save money by not buying so many desktop machines. Supporting student provisioned technology might mean spending any savings in creating new types of facilities

> *so they are using their own **laptops** but when you look at the way they are sitting – ergonomically it's a nightmare. They are certainly not comfortable in the way they are arranged so we need to address this.*
>
> *Associate Professor, Information Technology, QUT*

It might also mean changing investments from a predominant focus on hardware to the better enabling student access to specialist software.

> *what I find is lots of our students have their own laptops,* ***tablet*** *PC, whatever you called them, they have the latest phones naturally. But number one they don't have the software we have,*
>
> *Lecturer, Information Technology, CDU*

In the end, most academics see a role for better tools and applications to enable easily access to existing resources and knowledge, to support student communication, and collaboration, to encourage student brainstorming and decision making, to facilitate the generation of new ideas or knowledge and capturing classroom activities.

> *So I'd like to see in a space: room for students to break out into small groups; to be able to in those small groups use* ***technology*** *when needed to keep records of their* ***creative*** *process, their idea generation, to record some of their thinking and their thoughts, some of their initial design ideas, for example. It'd also be great if they had some project management tools in that space, some* ***collaborative*** *tools that helped them keep track of the tasks they were engaged in, roles they were playing, the resources they were developing through the project.*
>
> *Senior Lecturer, Creative Industries, QUT*

> *I would like, ... the idea that you could have a bank of* ***laptop*** *computers that you could wheel out and plonk on the table and use it if you want that they could [be]* ***wireless*** *and they could project up on a screen the stuff their teams are working on. They could break up into small teams a little bit over there and a little bit over there, and they could also come back together so they've got a flat space to work in they can move the furniture around. They can bring a laptop if they want to whether we provide it in a bank of laptops or whether they bring it in themselves.*
>
> *Associate Professor, Information Technology, QUT*

> *we start to thinking about using the* ***cameras*** *for interviewing students practicing, so they can reflect on their interviewing techniques, hiring or buying some cameras, and some video recorders, so students actually can* ***reflect*** *back on them, they could* ***observe*** *themselves, they would, they have list of skills that we have tried to get them to demonstrate, and they can look at those, look at themselves on camera, so that was quite good results come out with that*
>
> *Associate Professor, Nursing, CDU*

Whatever form the technology takes, there is a need to recognise the speed of change associated with technology in learning spaces. It is important then that the design of any new system or solution include provision for the degree to which a system might be extended as well as the degree to which the system can be interconnected with other systems. It also means a conscious avoidance, of solutions that require a particular hardware platform or configuration, applications that require platform specific client software or specific browsers, and infrastructure elements that restrict

academics and students from utilising appropriate solutions provisioned outside the institution. The academic perspectives are summarized in rich picture form in Figure 3 below.

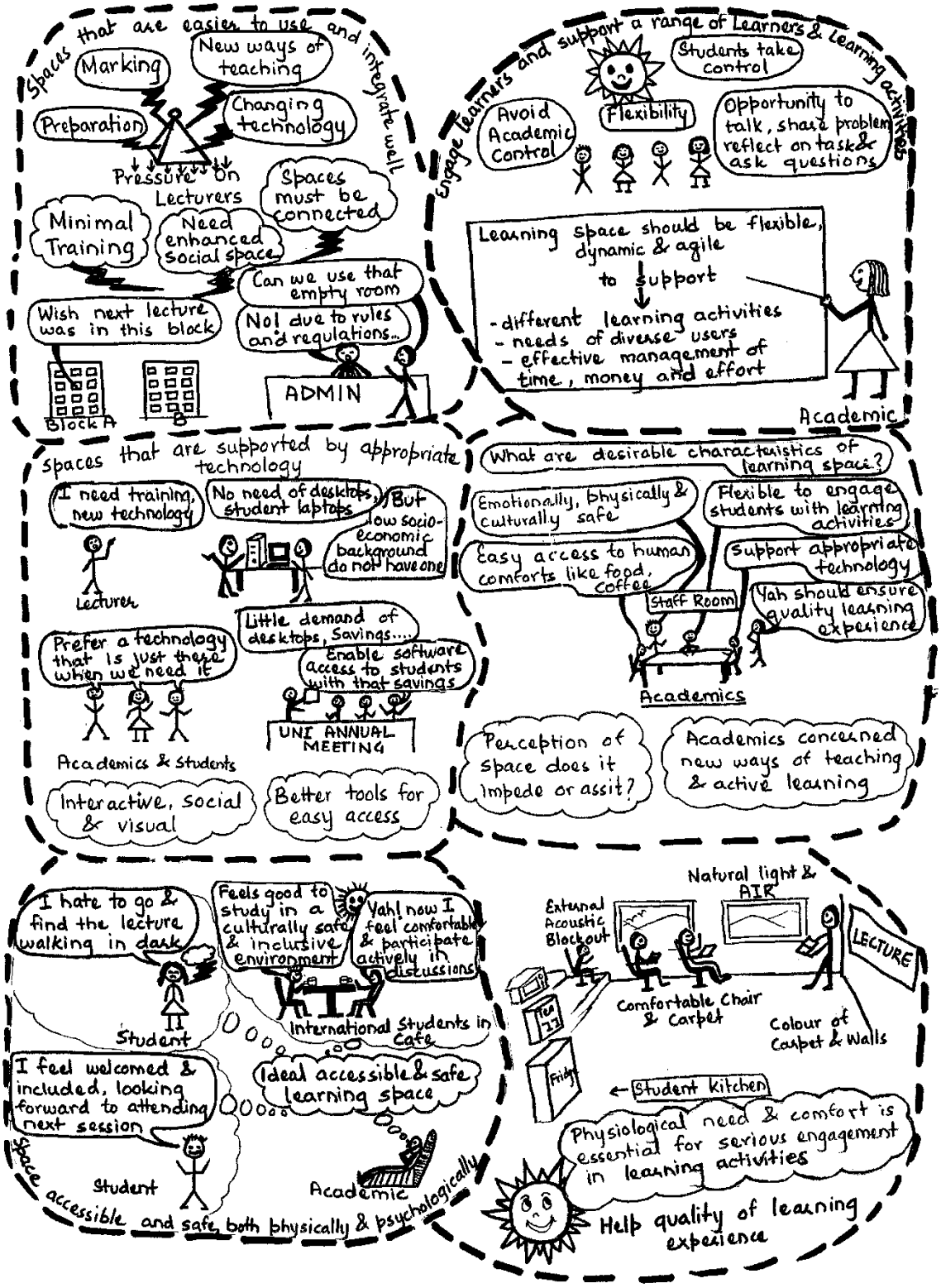

FIGURE 5 - RICH PICTURE REPRESENTATION OF ACADEMIC PERSPECTIVES OF LEARNING SPACES

THE PROFESSIONAL AND SUPPORT STAFF PERSPECTIVE

While students and academics spend large parts of their academics weeks utilising learning spaces, there is another group of people in most universities who spend their whole week thinking about, designing, developing, managing and maintaining learning spaces. The management of learning spaces involves a broad community of individuals and groups in organisational areas like Facilities Management, Information Technology, Audio Visual, Timetabling, Cleaning and Security, as well as people responsible for specialist learning spaces like libraries, learning commons, and computer labs.

This final group of key community members (people) in the learning space framework are largely professional staff who try and balance the often competing needs of the university as it relates to space in general, and learning space in particular. These competing needs take the complexities associated with any single space and increases it one hundred fold

> *I brought some stats, just to tell you what the **complexities** are. For semester one this year, we had 6,100 classes every week across the three campuses, including Caboolture. One thousand, two hundred different subjects, from all the eight different faculties and you can imagine the different sorts of teaching styles and learning styles that that had to cover. And we did that in 192 different teaching spaces that are controlled centrally, which are accessible to all faculties. And, interestingly, there are 397 specialist locations. So, each of the faculties have got their laboratories, dance studios, kitchens, and all sorts of special places where they're tailor-made for a specific type of teaching/learning activity. So, that's the sort of **metrics** that we're dealing with as far as the teaching goes.*
>
> *Campus Coordinator, QUT*

To facilitate consideration of these perspectives 10 professional and support staff directly associated with learning space development and management where interviewed from across Charles Darwin University and Queensland University of Technology. The staff involved range from Directors of Facilities Management, Information Technology and the Library to capital works managers, timetabling managers and architects. Like the approach used for selecting academics, staff were purposively selected based on the level of their involvement in the learning spaces debate at their institution.

In the same manner as the analysis of the academic perspective, semi structured interviews were conducted lasting between 30 minutes and one hour. All interviews were recorded on video camera and later transcribed. The transcripts were analysed using Leximancer text analytics software to identify common terms and concepts and to discover key themes associated with learning space design. All transcripts were automatically analysed with the thesaurus and concept seeding based on the concepts generated from the literature derived learning space principles identified in chapter 2.

The analysis broadly identified a range of themes and concepts associated with notions of the need for flexible spaces that can respond to large and diverse groups of users, spaces of sufficient quality that they actively attract students and academics to use them, and spaces that are sustainable and affordable in the longer term.

Based on a straight frequency count the more popular principles in the minds of professional and support staff include flexible, learning, comfortable, spaces, wireless, engaging, timetabling, power, affordable, technology, maintainable, interactive, students, reliable, connected, functional, coffee and mobile. Figure 6 below presents a more detailed word cloud drawn from a summary of the most commonly found words in professional and support staff transcripts regarding desirable learning spaces characteristics.

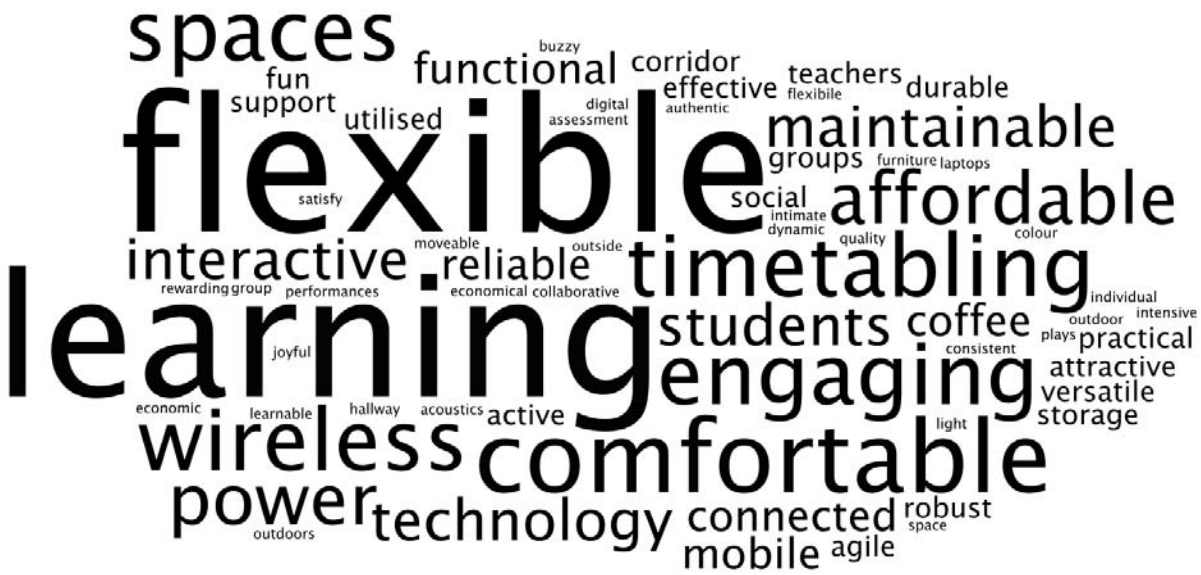

FIGURE 6 - DESIRABLE CHARACTERISTICS OF LEARNING SPACES FROM THE PROFESSIONAL AND SUPPORT STAFF PERSPECTIVE

It has often been suggested that professional and support staff don't speak the same language as academics and students. However, comparing the frequency lists provides some interesting observations. Concepts one and two on both lists are the same albeit in reverse order. For both academics and professional and support staff, priority is given to issues associated with the need to develop spaces to support learning and the need to develop flexible spaces that respond to changing demands. When we look at the other terms common to both lists we can see shared interests in comfortable spaces, engaging spaces, wireless and technology provisioned spaces, spaces that support student interaction and spaces that provide easy access to human comforts like coffee.

Comparing lists in terms of what is not there is difficult in that many things are shared on the overall list, although they are given different priorities. Concepts that have a seemingly higher priority for academics include social and dynamic spaces, spaces with more natural light and colour and the need to provide appropriate support. For professional and support staff, perhaps unsurprisingly, higher priority is given to practical aspects like timetabling challenges, providing power in informal spaces, and ensuring spaces are affordable, functional, reliable and maintainable. Given the commonality of many of the key elements it is perhaps difficult to argue that professional and support staff do not understand academic needs, but rather, it is perhaps more accurate to suggest that they have different priorities in some areas. Perhaps most interestingly of all, the difference between academic views and those of university professional and support staff are no different in their extent than the difference between academic views and student views.

Moving beyond basic concepts, an analysis of professional and support staff views reveals six major themes:

- Spaces need to be flexible enough to respond to a diverse groups of users and new and emerging approaches to learning
- Spaces need to be of sufficient quality that they actively attract students and academics to use them
- Spaces need to be simple to use and easily learnable
- Spaces need to relate well to the connecting spaces around them
- Spaces need to be affordable, sustainable and maintainable both now and in the longer term
- Spaces need to be supported by appropriate levels of useful technology

Each of these themes will be explored in more detail in the following sections, again using the voice of the managers where possible. Again extract from transcripts are shown indented to clearly distinguish between actual professional and support staff views and our interpretations of those views.

SPACES THAT RESPOND TO A DIVERSE GROUPS OF USERS AND NEW APPROACHES TO LEARNING

As we have already seen with academics, one of the most common themes amongst most professional and support staff interviewed is the desire for spaces to be flexible enough to support a range of different users and learning activities. Indeed the top two words by frequency are flexible and learning. Like academics, flexibility can mean different things to different people but importantly the perspective of most people involved in managing space includes a strong focus on the need to support learning and learning outcomes.

Obviously for many professional staff involved in dealing with learning spaces, the issue of scale of responsibility can be a significant motivator in terms of any desire to have flexible spaces

> *In the university, we've got around about 3,500 different teachers and 40,000* ***different*** *students. The ideal learning environment is something I think that ultimately will satisfy all of those requirements from the teachers' perspectives and the students' perspective, and we have to come up with some sort of happy medium.*
>
> *Campus Coordinator, QUT*

Recognising that even if a 'happy medium' can be achieved through the right blend of well designed spaces, the requirements that drive space designs are ever changing. Consequently there is a need to make sure that new building developments (which have long life cycles) need to be flexible enough to respond to changes in learning requirements (which often occur in far shorter periods)

> *There are some great opportunities there for us to really rethink how we want to do our latest round of teaching spaces. One thing we've got to be cautious about, that building, once it's finished won't have a major refit for probably 15-20 years. And so what we've got to put in there has got to be **flexible** enough to accommodate the change. And been it's scary, the rate of change in teaching spaces,*
>
> *Director Facilities Management, QUT*

Adding to this problem is the reality that the teaching and learning requirements are not the only drivers behind the design of new spaces. Even when we considered the increased use of learning spaces that has resulted in recent years with the move to summer teaching semester, non standard teaching modes and intensive offerings, a reasonable percentage of our formal learning spaces are not necessarily in use all year

> *We don't teach for 52 weeks of the year. We only basically do13 weeks each semester. So for roughly half the year, all of our teaching space is fallow, so we need to use that for other things, which is usually some sort of educational activity but, ideally what we use for teaching can be used for other things during the **fallow** periods.*
>
> *Manager Campus Management, QUT*

Compounding this complexity, is the fact that, useful spaces designs that have been successful in one school, faculty, campus or university will not necessarily translate easily to new situations. Student cohorts, and the programmes they are involved in, can vary dramatically across the country

> *...so good learning environment for me is **flexible**, it has to be accommodate, for us it's diverse range of client need, we have CDU a very diverse client base, from internal to students who study externally but live locally, so they still come to the space in the evening in the weekends, we have a large number of maturity age students who come back for studies, so for some of them, this is the first sort of study has done in online, technology enabled environment, so they have particular challenges in coming back to study, we also have international students, it's quite culturally **diverse** student population*
>
> *Associate Director, Library, CDU*

This means that no one-size-fits-all solution can be easily applied to every project. Despite this, there are some common requirements, at the level of individual spaces, which are common to most circumstances. Many professional and support staff openly recognise academics and student desires to utilise spaces that are easily reconfigured based on the needs of the learning activity occurring

> ***Flexible** is the ability to modify the space to suit what you're doing at the time and if you're going to lecture, then it needs to be able to get people's attention; and basically face you and be able to **interact** at that level. But, then if you want to move straight into some other mode, then you've got to be able to **reconfigure**. So the flexibility to do that – reconfigure to that mode. Then you can walk around and talk to students in their groups; get them to face each other*

> *and work at a table. So that's a high degree of flexibility that I think we need, and we have in some areas.*

Manager, Technology Services, QUT

> *I think very much the ideal space is a **flexible** space because there's no typical student and no typical way of studying, so creating a space where people are **comfortable** to learn is probably the most important thing And to be comfortable, you've got to manipulate and learn to adjust the space around you.*

Consulting Architect

Despite the often cited criticism or stated difficulties in getting the broad array of space stakeholders to agree on key principles behind the design of learning spaces, there is clear evidence that professional and support staff place considerable weight on the need for learning to be a key driver in the design equation

> *With my purely FM hat on, the only reason we provide space in the university is for people to use, to facilitate an outcome. So, in this case you're looking for a **learning** outcome. But, for a lot of the spaces, it's not just learning or it's learning in a broader way, can become partly a socialisation space as well. So you have to sometimes keep that in mind. But for us, the space works well if the students learn there.*

Director Facilities Management, QUT

> *Simply, and ideal learning environment is one that allows us to do what we want to do in terms of achieving the **learning** outcomes for the staff, and the students that are part of their curriculum. It doesn't have to be big. It doesn't have to be small, or blue, or black, or a certain shape. It just has to be right for the occasion*

Director, Learning Environments, QUT

Facilities managers are cognizant not only the need for a focus on learning but are also aware of the changing nature of pedagogy

> *the dominant theme is that we're certainly in a different environment from when everyone sat in rows and looked at the teacher. We understand that it's probably **group** learning that's becoming an important element. While we might still have other sorts of learning and other physical arrangements to facilitate that, the big modern impetus would be on grouped. What sizes of groups, how they might form and re-form, and how they might jump from one table to another in one space*

Associate Director, Capital Works, QUT

They are also cognizant of the change from academic driven learning to student controlled learning

> *The space should be **flexible**, we should be able to change the space or students should be able to change the space*

Manager, Facilities Management, CDU

There is also clear evidence of a commitment by these professional groupings to develop this understanding further so that their staff are keenly aware of what staff and student needs are and how the design and management of spaces can impact on those needs.

> *A better understanding from support services staff about, what students tend to learn, why we have lecture theatres, why we have formal spaces with rows of desks, why we have social spaces where people you know, my staff [do] not really understand that, I didn't understand until 12 months ago, I did lots of research to understand teaching spaces, lecturers needs, students need, ... you know, critical learning ... I have staff they don't see that, they only see customer needs, because we generally **interact** with the staff, and the customers, the students [are] generally once or twice removed, so that kind of education for facility staff, the value they add, or they can't add is also [important to] understand.*
>
> *Manager, Facilities Management, CDU*

This awareness of the need to better connect does not stop with academics and students but extends right across the whole array of stakeholders involved in the design and management of spaces

> *The increased requirement upon us, over the last 10 years, is to be much more adept at very complicated **teamwork**, to provide highly performing and **engaging** learning spaces. And I'm very pleased to see the level of teamwork that has emerged over that time between the various skill groups that need to be brought to bear. The relationship that I see between the AV people, the audiovisual people and my network people is so important to the success of these learning spaces. But you could extend that out. You could probably identify, if you wanted to list them all off, fifteen or twenty skill groups that would be quite crucial to the success of our learning spaces. And so I think the challenge for the university to excel in this regard is to be especially good at the collaboration at the interworking across those multiple disciplines, to bring together those folk in a way where they share a vision for these learning spaces into the future and then can align their efforts towards achieving that vision.*
>
> *Director, Information Technology, QUT*

In the end, the evidence suggests that it is a fallacy to suggest that professional staff responsible for learning spaces cannot understand or appreciate the concerns of academics and students. Indeed the evidence suggests that in most cases they are keenly aware of them and in some detail. It can be argued that if any university is to truly 'achieve their vision' for the future of learning spaces, then all stakeholders in the learning space debate need to share some mutual aspirations, at least in the area of supporting learning outcomes.

SPACES THAT ACTIVELY ATTRACT STUDENTS AND ACADEMICS TO USE THEM

The question of making spaces something that attracts academics and students to use it registered highly with many of those interviewed. Like many academics, there was also a desire by some professional staff for spaces to move away from institutional conformity to include a sense of fun and interest

> *Well, certainly "**attractive**". They've got to draw people in. So they have to be attractive, in the first instance. You know, "I want to go there, because it looks like a great place to go". So that'd be the first word – attractive. The second word would be "**fun**", or "**engaging**", because when they get there they've got to have an experience that makes them want to stay, because it's rewarding, it's fun, it's **energising** – all of those sorts of things.*
>
> *Director, Information Technology, QUT*

Based on the metric that the best spaces are those that people use, many interviewees spoke about creating spaces with a sense of buzz to it, where lots of people could gather and interact with each other.

> *From our point of view, the best indicator is always it's a very **dynamic** space and the best way to get that is to fill it up with people: students or academics. You can tell a popular space; it's full of people and there's a real **buzz** to it and, that's why we think the learning experience is not just in the dedicated teaching classroom area.*
>
> *Associate Director, Capital Works, QUT*

> *Probably the big one for me, I really like to move on the **indoor** and **outdoor**, I guess it's frustrating, we know at the moment it's a big focus here on distance, study online, you know, students are external, and yet, anytime I go to my office, that space is **buzzy**, it's full, they are here, whether they are internal or external, they are here in the space, I think we need to take account that in terms of more about what we offer them on campus, in fact the significant number of them are here, after the time, you can buy a cup of coffee*
>
> *Associate Director, Library, CDU*

Unlike responses from academics the question of colour was not raised as often but it was certainly an issue for some

> *I love that idea having sort of **colour** within a building, so it's not kind of drab and bland, it tends to be a little bit **lifting***
>
> *Associate Director, Library, CDU*

For others, spaces could be made more engaging by creating connections between students and their intended professions or areas of study. Some argued that the inclusion of these sorts of elements make the students feel both connected to a broader community and gave them some sense of place in the university

> *Ideally, I think there needs to be a lot of **engagement**. That's probably one of the key words. No doubt you've heard that a lot. It should have the ability to make students really feel **comfortable** in their environment, and to be able to engage well... I like to have learning environments that are **rich**. So if there is the possibility to have things around that depict, say the profession of the student, or some sort of connection that they have. Now that may just be that it's in an area that's close to their – that they feel more of a **connection** with. It may be in a*

> *building. It may be the engineering building or the design building, and so they have a lecture there but, it could also mean that they've got pictures on the walls or some kind of artefacts around that they can **engage** with, so that's useful.*
>
> *Manager, Technology Services, Built Environment, QUT*

Space utilisation has long been an important metric for facilities managers, but it is clear that this now means more than just how many people can be timetabled into any number of given spaces. It now includes a view of spaces as being desirable destinations where students and staff might actively seek to use for more than just prescribed classes.

SPACES THAT ARE SIMPLE TO USE AND EASILY LEARNABLE

An important caveat to the view that spaces can be created that encourage people to use them (because of design elements like increased comfort, flexibility, colour) is a caution that new learning spaces can often be daunting spaces for some. Modern learning spaces can often incorporate such an extensive array of information technology and audio visual solutions that many users often feel overwhelmed

> *I guess one of the challenges is the **diversity** [of the] client base, and that just in terms of ... different levels of confidence with technology, so that means us having to take that into account to show our own staff, to train appropriately with result to be able to deal with that*
>
> *Associate Director, Library, CDU*

For many of those directly associated with either the design and management of space in general or the utilisation of specialist spaces, there was a clear desire to both make spaces simple and easy to use and for the use of spaces and the elements within in them as self evident as possible

> *And spaces that, I think, are easy to find and it's **self evident** what you can do in those spaces because we know, for example, that signage really doesn't work and so it's got to be obvious to the student how they can use the space.*
>
> *Director, Library, QUT*

For others there was a clear need to ensure that adequate training was made available to staff and student using new spaces. Many of those interviewed were keenly aware that academics might find newer learning spaces uncomfortable because of the disparity between the demands of the space and their perceived capabilities to utilise it. They argued that there was a need for simple, timely support to help overcome any levels of concern or discomfort

> *people will feel uncomfortable when they are pushed into a space that they don't feel **competent** to use or perhaps doesn't suit their style of teaching.. So, I think we've got to try to help people to use the space effectively. I think a lot of people would like to but, sometimes they get scared. I mean, I only just got broadband at home last year, after getting sick of falling over the cable for the dial up for the umpteenth time. So, you've got to help people get there... Keep it simple. You don't want a manual in a box beside the door*
>
> *Director Facilities Management, QUT*

> *I think one of the things that's happening now is that a lot of teachers are being dragged kicking and screaming into the new world of **flexible** delivery and I think that's probably causing a problem, because there is a lot of resistance as a result of that. I think they need to let a lot of the more traditional teachers – and some of the newer ones – who don't have training in how to teach, give them more time to find their way.*
>
> *Manager, Campus Management, QUT*

One of the contributing factors to this discomfort can be a fear of the unknown or the potential for things to go wrong. Anxiety associated with things not working can be a considerable concern for many new academics, or even more experienced academics trying new approaches to learning for the first time. As a result, it is important that quality of the learning space include more than the fabric of the chairs and the sturdiness of the tables. It is important that all elements (especially technological elements) are reliable, and 'just work as advertised'

> *And the third thing I would say – they have to be "**consistent**", or "**quality**", I guess is the best word, but it's about the kind of experience people have when they go to these places, that they're reliable, they work, things don't fall over.*
>
> *Director, Information Technology, QUT*

The design of learning spaces needs to accommodate a wide range of literacy levels in users i.e. it should be easy for a novice user to learn and for an experienced user to utilise its advanced functionality. Careful thought needs to be given to help users transition from older more traditional spaces to new more active learning space. It is worth echoing the thought that simplicity is often a product of making conscious choices about what elements not to include in the design of a learning space.

SPACES THAT RELATE WELL TO THE CONNECTING SPACES AROUND THEM

Professional and support staff recognise that learning spaces can no longer be thought of solely as complex room numbering and categorisation systems. Changes in emerging learning activities means that students need to move about a range of spaces in order to undertake different aspects of a single learning activity. One consequence is that the traditional notion of what constitutes a learning space is being challenged

> *But, there is nowhere that isn't a learning space now. So, when we're designing spaces, that is taken very much into account. A hallway is now longer a pristine passage for people to get from A to B. It's a place where people can linger.*
>
> *Director Facilities Management, QUT*

It has long been recognised that around 70% of all learning occurs outside the formal classroom and that learning has a strong social element. What professional and support staff are now interested in is how that informal learning process in social spaces can be better supported.

> *The other facilities we're trying to encourage is what you'd think of as corridor learning. The boundaries between the corridors and the classrooms is a lot fuzzier, and the **coffee** shops; people are doing learning across a broader range of areas. The key theme is – where you can tell it's happening is a group of people*

> *gathering around something, usually a laptop screen, or discussing something, or a whiteboard.*

Associate Director, Capital Works, QUT

Most universities understand that technologies like wireless should be activated in all informal spaces like coffee shops, gardens and other outdoor areas as well as in formal learning spaces

> *So what does that mean in terms of mobile and agile spaces? What does it mean to take greater advantage of coffee shops as learning spaces? We have to stop tying ourselves down, we have to untether ourselves and think about what we can do to make use of all the space that's available to us and not just the space that QUT owns, or leases or whatever. There's opportunities for us everywhere.*

Director, Information Technology Services, QUT

Perhaps less well understood or enacted is the opportunity to utlise simple outdoor areas as more than just places for students to gather. Some professional and support staff argue that one of the most unrealised space opportunities on most campuses is outdoor spaces and spaces between building

> *We can get good bang for our buck by having a small space in a passageway, or because we're in Brisbane we've got terrific weather, people can sit **outside**. You've got to provide some shade. Power outside is a bit of a problem. One of our recent buildings, in the student learning and support centre, where we've got that shaded area outside, we've put external power points in there so people can recharge their laptops.*

Director Facilities Management, QUT

Other professional and support staff argue that the real challenge is not activating unused spaces but facilitating the easy movement between spaces. Wireless is often offered as the solution to utilising outdoors space, however there is a need to make sure that wireless allows seamless movement without the need to log off and log on each time a student moves

> *Part of the problem with old style sort of wireless is: I go into the space, I log on, when I finish I log off, I go somewhere else and then when I get to the next space I have to restart my learning activity again because I have to bring up all the technology. So it really needs to be a very **mobile** kind of experience, so that the technology allows the easy transition across those kind of spaces*

Director, Learning Environments, QUT

Clearly, the notion of what constitutes a learning space is evolving, and it is clear that the issue of how to activate new spaces is something that many professional and support staff are actively pursuing.

SPACES THAT ARE AFFORDABLE, SUSTAINABLE AND MAINTAINABLE BOTH NOW AND IN THE LONGER TERM

Unsurprisingly, one area where professional and support staff perspectives different in terms of priority from academics and students is around the economics of learning space. This question of

economics has a number of different facets all of which can have significant impacts on the number, quality and diversity of learning spaces available to academics and students

> *Purely from an FM point of view, we would like everything to cost no more than a dollar a square metre and require no **maintenance** ever then, we wake up and realize realise it's not going to happen. What we are after is something that is reasonably **economic**, and is easy to **maintain**. By maintenance I mean the physical repair but, also things like cleaning, that it operates well and doesn't impact on the people next door. So if you have a very noisy space, you're going to have problems with the adjacent neighbours.*
>
> *Director Facilities Management, QUT*

Part of the concerns around affordability are driven by the simple facts of limited budgets and increasing demands necessitating a focus on cost effective solutions

> *We never have enough money to spend on facilities, so we need to spend it wisely. We can't spend a lot of money on lavish projects. As I said, we have a large **portfolio** of old projects, so we need to get a good economy and a lot of bang for our buck.*
>
> *Associate Director, Capital Works, QUT*

Another aspect of affordability is associated with some of the drivers behind the desire for flexibility. In an environment of changing requirements, investments in elements that can't be changed or reconfigured may not be a wise long term investment

> *What we try to avoid is specialist furniture. With joinery, try to avoid specialist joinery. One thing that's happening now is that everything's ending up on wheels, because people want that flexibility and that's great for making things affordable, because it's a bit of a shame when you build a really flash piece of joinery, which is based on the personal whim of someone who would like to use that space and doesn't suit others. Whereas putting things on wheels always gives you the opportunity to change things around.*
>
> *Director Facilities Management, QUT*

This question is especially true in terms of technology not only because of its rapidly changing nature pout also the notion of faddism that can occur which might encourage an institution to invest heavily in a show piece type of technology that might rapidly date

> *as you know, three years is a long time in the technology world. ... We don't want to build something that's so peculiarly specific it can only do what we're doing with it then, because we know from experience three years from now that could be out of date.*
>
> *Associate Director, Capital Works, QUT*

The question of sound long term investments is a complicated question given the different notions of what long term means and how difficult it is to predict future use in relatively short time periods.

A number of professional and support staff interviewed spoke about the differing life spans of buildings, internal fit-outs and technology

> *There are different layers and lifetimes. A **building** itself we design for 50 years; that's the physical, structural shell ... More realistically, the internal fit out of that building really probably does only have a 15 year life span. Some will stay in that configuration forever, obviously but, quite often a lot will need to be updated and refitted out of that stage. **Technology** is probably working on a two or three year life cycle. So, it's very presumptuous to, you know – "Where are we going?" as you say. Where we are at the moment, not too many really people predicted.*

Associate Director, Capital Works, QUT

It was also argued that it is important to remember that costs are not just associated with the original development of a space, and that there are considerable costs associated with the ongoing use of a space that need to be considered

> *The design isn't just the shape of the room, the design is the utility going to the room, so energy **efficiency** factually are primary, what makes a space special, not just delivering the teaching, but this piece of space represent the **environmental** perspectives. So in designing, in looking at a space, not just the room for teach, it's the whole building, the whole thing, that's what I'm trying to do,*

Manager, Facilities Management, CDU

A stronger focus on affordability and the potential ongoing costs associated with new learning spaces is perhaps one area where a clear distinction can be seen between professional and support staff and other learning space stakeholder groups. However, it is incorrect to say that other stakeholder groups do not share at least some appreciation for the implications

> *I think it's good that in some parts in some places you have the bee's knees of the greatest, newest, shiniest, most fabulous diamond encrusted room. That would be good. We can have one of them but, I think we should be probably a little hesitant about investing in three of those and not then having a really wide range of other spaces... I get a bit worried when I go see us do new things and it's got this fabulous furniture and beautiful bits and bobs, and I think: that's just asking for a very high maintenance budget. I think we could probably do more with less.*

Associate Professor, Built Environment, QUT

In the end, concerns over affordability and maintainability, are important elements to be considered when redesigning learning spaces. Money spent developing or maintaining any space is money that is not available to improve other spaces. If the objective is to improve the learning outcomes for all students then these are important considerations.

SPACES THAT ARE SUPPORTED BY APPROPRIATE LEVELS OF USEFUL TECHNOLOGY

It has become somewhat axiomatic that discussions regarding learning spaces always involve some discussion regarding the role of technology in one form or another. It is perhaps unsurprising then that the issue of technology was covered by most of the professional and support staff interviewed. For some that need to include technology is taken for granted

> *.., and that space should be rich in **technology**, so people can access into the information that they need to access, or equally the lecturers can deliver the information that needs to be delivered in whatever the formats they want.*
>
> *Manager, Facilities Management, CDU*

For some the need for technology is simply a reality driven not necessarily by academic need for technology to support learning activities, but by student expectations that technology use in learning spaces will match the level of use in broader society

> *Where I might have been five years ago the only one who would have something, a device whose functionality approximated an iPhone, now everyone's got one. Both of my sons have got them and all of the kids on my son's hockey team have got an iPhone. So what does that enable us to do, in terms of learning spaces? Pretty fundamentally different things. And they can't just be constrained to the borders QUT sees itself owning and being responsible for. ...I think we have to look at what becomes possible with the technologies that are in the hands of everyone in that real world.*
>
> *Director, Information Technology, QUT*

Despite the sometimes knee jerk reaction, this doesn't mean that universities no longer have any responsibility for the provision of technology in learning spaces. It does mean that the level of the debate can move from one driven by the student/PC ratio metric to more careful consideration of providing technology that adds value

> *I think leveraging the commodity or **consumer** devices that students and staff have doesn't remove the obligation or opportunity for the university to add significant value. I think what we have to be clever about in moving up the value chain is finding ways of doing things that exploit and take advantage of those things that people will have available to them readily as consumer devices, but help them move up.*
>
> *Director, Information Technology, QUT*

Part of the role of the university is to provide the infrastructure necessary for student to move easily about the campus and remain connected to the relevant technology

> *So it really needs to be a very **mobile** kind of experience, so that the technology allows the easy **transition** across those kind of spaces and that the kind of furniture in those spaces allows them to engage with the things that they're doing.*
>
> *Director, Learning Environments, QUT*

Having said all that, the technology systems in any learning space must be simple to use, reliable and supportable by technical personnel so that problems do not distract students or academics from the task at hand. The technology in learning spaces needs to accommodate a wide range of literacy levels in users i.e. it should be easy for a novice user to learn and for an experienced user to utilise its advanced functionality

> *I see many universities struggling with this phenomenon of **pioneers** blazing away, massive investments in one building led by two or three pioneers, but that not translating into mainstream adoption of those benefits. And in fact, the mainstream being left behind, being isolated from it*
>
> *Director, Information Technology, QUT*

The question of accommodating a wide array of literacies dovetails with an emerging desire to make sure that technology is there when you want it but can be easily moved out of the way when it is not needed. The question of unobtrusive technology is one that challenges many of the professional and support staff interviewed

> *increasingly, the curriculum requires students to work in groups. And of course there's a technology aspect to that, as well. But we need to be clever about the deployment of the technology so it's there, but it's not technology for technology's sake. And that it's able to be used and is presented or supplied in such a way that it doesn't impinge on the space, if you like.*
>
> *Director, Library, QUT*

> *So you'd need to be able to have technologies that are really **useful** to that environment and **accessible** and easy to use but, don't get in the way. So I wouldn't actually like to use a space that was full enabled with computers all the time. You've got to have some mechanism – whether it's through the software or whatever – to shut them down and say, "Listen, we've got to concentrate on this, not on your email."*
>
> *Manager, Technology Services, QUT*

> *We're also seeing in IT **enabled** spaces that there's a sort of a theme by the sort of non-digital teachers to get rid of that IT and be able just sit around the table. So just people sitting around a table and talk. So, I think there might have been a trend in the recent years to just IT everything, put computers everywhere, and everyone works off a computer, individually and in a group, and in the whole room. But, you also need to put that computer away and just sort of sit around in a group and just talk and see each other, without a computer in front of you*
>
> *Consulting Architect*

In the end, it is clear that the question of technology provision in learning spaces is one that is undergoing considerable reconsideration across many universities. Questions abound as to which technology makes sense to include, how do learning spaces best respond to the opportunities of consumer technologies and best meet the dual challenge of making a space technology enabled but not technology dominated. Professional staff perspectives are summarized in rich picture format in Figure 7 below.

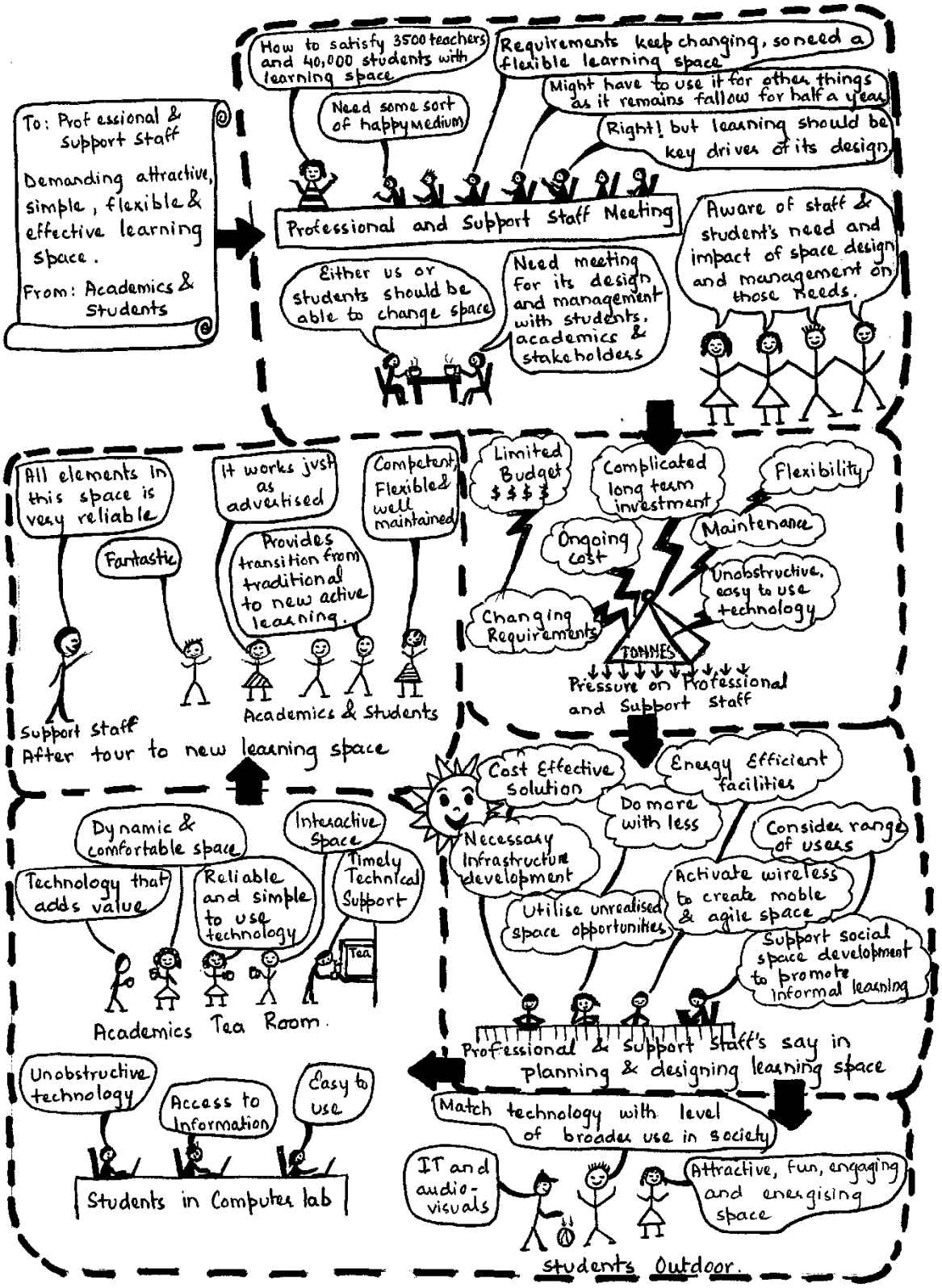

FIGURE 7 - RICH PICTURE REPRESENTATION OF PROFESSIONAL STAFF PERSPECTIVES OF LEARNING SPACES

TOWARDS AN INTEGRATED SET OF PRINCIPLES

When these themes are amalgamated, a number of common perspectives tend to stand out. These include supporting a range of learning activities, encouraging student engagement and interactivity, providing a high quality environment, empowering users to achieve their learning goals, providing a safe environment, ensuring ease of use and providing access to appropriate levels of technology. Bringing these concepts together into a succinct set of principles reveals the following list:

1. Spaces should support a range of learners and learning activities **[students, academics, professional]**
2. Spaces should provide a quality experience for users **[students, academics, professional]**
3. Spaces should help foster a sense of emotional and cultural safety **[academics]**
4. Spaces should enable easy access by everyone **[students, professional]**
5. Spaces should emphasize simplicity of design **[students, professional]**
6. Spaces should integrate seamlessly with other physical and virtual spaces **[academics, professional]**
7. Space should be fit-for-purpose, now and into the future **[professional]**
8. Spaces should embed a range of appropriate, reliable and effective technologies **[students, academics, professional]**

At the simplest level, the challenge of designing effective learning spaces is a classical usability and utility problem. A range of frameworks already exist in the fields of product design that offer a useful way of considering this set of principles. The LUCID framework (Kreitzberg 2008), for example, suggests that the design of any interactive product requires attention to four key characteristics: Engagement, Empowerment, Ease-of-Use and Trust. With minor amendments to this last item, it is possible to overlay this framework on the PST framework (Radcliffe, et al., 2009) and develop a model that brings together a range of different aspects of learning space design and use.

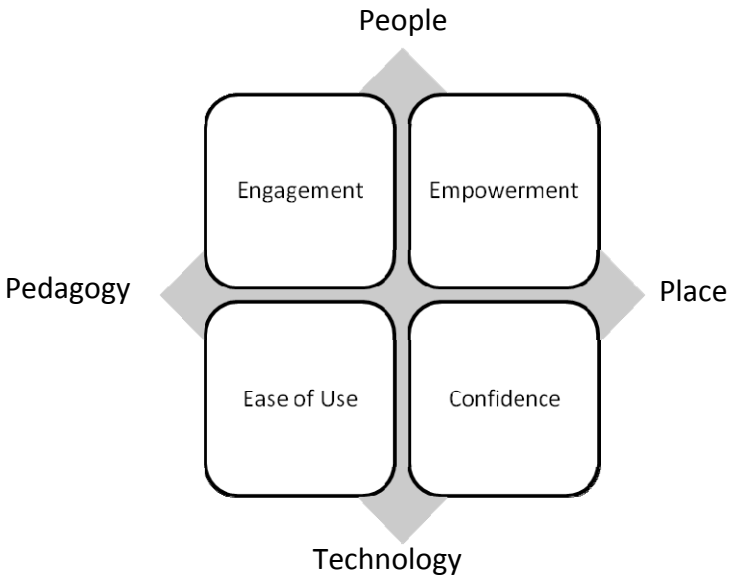

FIGURE 8 - E3C MODEL FOR LEARNING SPACE DESIGN

Consistent with recent developments in learning space design (Brown, 2009) this model is not about 'stuff' but about what students and staff can do in learning spaces. The following sections describe each principle in more detail

ENGAGEMENT PRINCIPLES

Principle 1: Spaces should support a range of learners and learning activities
Key words: agile, dynamic, adaptable, inspiring, stimulating, challenging, engaging

Research has shown that deeper learning occurs when academics and students are engaged in an active learning process as partners. As a consequence learning spaces should support engagement through easy facilitation of activities like team based collaboration, idea generation, brainstorming, problem exploration and decision making, and artefact generation that extends beyond simply text and image creation.

To be able to facilitate such a broad range of activities, spaces should be agile enough to support a range of current and emerging pedagogies that span a range of related domains from academically directed to student led learning; from individual to team based learning; from theoretical analysis and critique to authentic and work integrated learning. Space design (and associated support activities like timetabling) needs to accommodate learning modalities that extend beyond the dominant lecture/tutorial model to models that emphasise a precinct type approach to space utilisation supporting access to a range of related spaces in varying time modalities.

Spaces should utilise appropriate elements like colour and art works to encourage creativity and a sense of excitement as well as stimulate and challenge learners. Student feedback regularly indicates how much they notice the aesthetics of spaces.

Principle 2: Spaces should provide a quality experience for users
Keywords: usable, comfortable, bright, spacious, attractive, fun

Learning environments should actively promote learning excellence. Spaces should be inviting and welcoming with comfortable furnishings. Spaces should have plenty of natural and variable light, good ventilation and good quality acoustic treatment.

The design of learning spaces should include consideration of student access to comfort elements, including food and beverage. Students are increasingly involved in learning activities that take place over long periods of time or occur in the evenings and on weekends. For this reason it is important to recognise their need to access adequate sustenance to ensure they have the mental capacity to continue their engagement with the learning activity underway. While this can be met in part by on campus cafes and restaurants, access to these resources outside normal hours also needs to be considered.

For similar reasons, the location of learning spaces also needs to give due consideration to safe and easy access to bathrooms, parents' rooms and relevant student and staff support resources. With learning spaces now being used for longer hours and in more intensive modes, access to these sorts of comfort facilities is increasingly important to the student experience.

Empowerment Principles

Principle 3: Spaces should help foster a sense of emotional and cultural safety

Keywords: welcoming, inclusive, nurturing, supportive, secure, positive, safe, motivating

Learning needs to occur in an environment where learners are free from any concerns about their physical and emotional safety, where they feel welcome and included. Most universities articulate capabilities for their graduates that include social and ethical responsibility and an understanding of Indigenous and international perspectives. Learning spaces and university campuses that avoid all sense of cultural identity do not assist students in developing these capabilities.

In creating a safe and inclusive environment, it is important that learning environments still encourage learners to consider their role in the global community and aid the discovery and development of a broader sense of cultural awareness in students

A sense of physical safety is created for academic and student users of learning spaces through high levels of lighting and activity in and around learning spaces. Proximity to security services, the lack of obvious vandalism and graffiti, and the cleanliness of spaces and related services like bathrooms all contribute to creating a sense of safety.

Principle 4: Spaces should enable easy access by everyone

Keywords: accessible, learnable, locatable, navigable, findable

The location, design and configuration of learning spaces should be undertaken cognizant of the broad range of capabilities of potential users. This consideration should range from the more obvious requirements like ensuring that spaces can be adequately accessed and used by students with a range of disabilities through to more subtle requirements like making it easy for students to find a learning space and be able to successfully transition between relevant spaces within the timeframes that their timetable requires. The same principles apply to the technology utilised in learning spaces. The design, placement and control of systems need to accommodate a wide range of potential users.

Ease of Use Principles

Principle 5: Spaces should emphasize simplicity of design

Keywords: functional, learnable, efficient, user centred

The intended use of a space, furniture or technology in a space should either be self evident to users or require minimal specialist training to utilise. It is important that the design elements in any space are easy to identify and use as intended. This can be assisted by having familiar look and feel approaches to room design, common standards for information technology and audio visual systems and simple and clear signage that indicates the role and purpose of any additional classroom element so that they can be utilised safely and with confidence. Support services should exist that can respond rapidly to problems in learning spaces to avoid major interruption to any learning activity, something which can be difficult given the extended time in which learning spaces are now in use on university campuses.

Modern learning spaces often incorporate such an extensive array of information technology and audio visual solutions that many users often feel overwhelmed. The technology systems in any

learning space must be simple to use, reliable and supportable by technical personnel so that problems do not distract students or academics from the task at hand. The technology in learning spaces should accommodate a wide range of literacy levels in users i.e. it should be easy for a novice user to learn and for an experienced user to utilise its advanced functionality. Care should be taken to introduce applications and control systems that echo interfaces that may already be familiar to users. Simplicity can also be a product of making conscious choices about what elements not to include in the design of a learning space.

Principle 6: Spaces should integrate seamlessly with other physical and virtual spaces
Keywords: blended, ubiquitous, temporal, social, connected

Learning spaces need to make it easy for students to connect with the world beyond the classroom and easily bring relevant resources back to use as part of their learning activities Many of the psychological principles of learning spaces promote the sense of students and academics being involved in an active community of learners. Strictly speaking, they belong not to a single community of learners but a number of often overlapping communities that draws in the broader university, their discipline and even the broader society.

Students need to move about a range of spaces in order to undertake different aspects of a single learning activity. It is important to ensure that learning spaces do not impede this movement or introduce elements that require distraction from the learning activity during the flow of activities. Technologies like wireless should be activated in all informal spaces like coffee shops, gardens and other outdoor areas as well as in formal learning spaces and where possible the infrastructure should allow seamless movement without the need to log off and log on each time a student moves. Simple technologies like mobile whiteboards or writeable surfaces should be utilised to allow students and student groups to break out of formal classrooms to engage in learning on the move.

The design of university campuses, buildings and learning spaces needs to support opportunities for accidental or serendipitous interaction between students and academics. Educational research suggests that considerable learning takes place informally and incidentally, beyond the explicitly designed activities of the classroom. Learning occurs in casual contacts with faculty and staff, peers, and in the broader context of university campus life.

CONFIDENCE PRINCIPLES

Principle 7: Space should be fit-for-purpose, now and into the future
Keywords: sustainable, maintainable, robust, agile, cost effective

Learning spaces need to be robust and fit for ongoing use. In order to support a focus on learning, most staff and students suggest that learning spaces and the technology in them needs to be available where and when they need them. Put simply “they just need to work”. To enable this, building fabric, furnishings and technology utilised in learning spaces should be durable and robust enough to support active use and possible reconfiguration over a period of time. Care should be taken when introducing elements into a learning space that introduces any undue maintenance burden or items that can be easily stolen or removed. The use of remote monitoring systems to monitor learning space technology can also support a more proactive approach to support and rapid response to faults.

In addition, learning space installation standards should be developed and adhered to allowing ongoing understanding of the maintenance requirements of complicated electrical, acoustic, audio visual, networking and computing installations. Similarly, the timetabling of learning spaces needs to adequately provide for suitable maintenance and refresh periods.

Principle 8: Spaces should embed a range of appropriate, reliable and effective technologies
Keywords: reliable, appropriate, effective, extensible, social, mobile, trustworthy, responsive, current

Technology in learning spaces should be designed to allow students to easily interact with classroom activities and with each other. Technology for technology sake should be avoided and the focus turned to technology that enhances learning and supports the social and interactive nature of modern pedagogies. Technology should be available to allow students to easily access existing resources and knowledge; generate new ideas or knowledge and to capture classroom activities allowing easy play back and review by students at the same time or for upload to personal learning environments (PLE's) or e-portfolio systems for review at a later time. A combination of institution provisioned technology and applications and student provisioned technology and applications should be supported that encourage student communication, collaboration, brainstorming and decision making.

In an environment where technology is constantly changing, institutions cannot hope to ever supply all the solutions, systems and hardware that academics and students might want to use in their learning activities. As a result it is important that those solutions that it does provide integrate well with the broader array of solutions and environments available. This means a conscious avoidance, where possible, of solutions that require a particular hardware platform or configuration, applications that require platform specific client software or specific browsers, and infrastructure elements that restrict academics and students from utilising appropriate solutions provisioned outside the institution. While complex, this ambition becomes progressively more critical when we observe the increasing array of laptops, net books, smart phones, and other mobile devices regularly being used by a broad spectrum of students.

These principles draw together concerns, consideration, desires and needs from a broad range of perspectives. Combined with more detailed guidelines like those presented in table 5, they provide a pragmatic framework for the redevelopment of university learning spaces. When there is a need to focus on cost effective solutions to improving student learning, a concise set of principles that take priority over other concerns is a persuasive starting point. This set of principles are represented in rich picture format in figure 9 below.

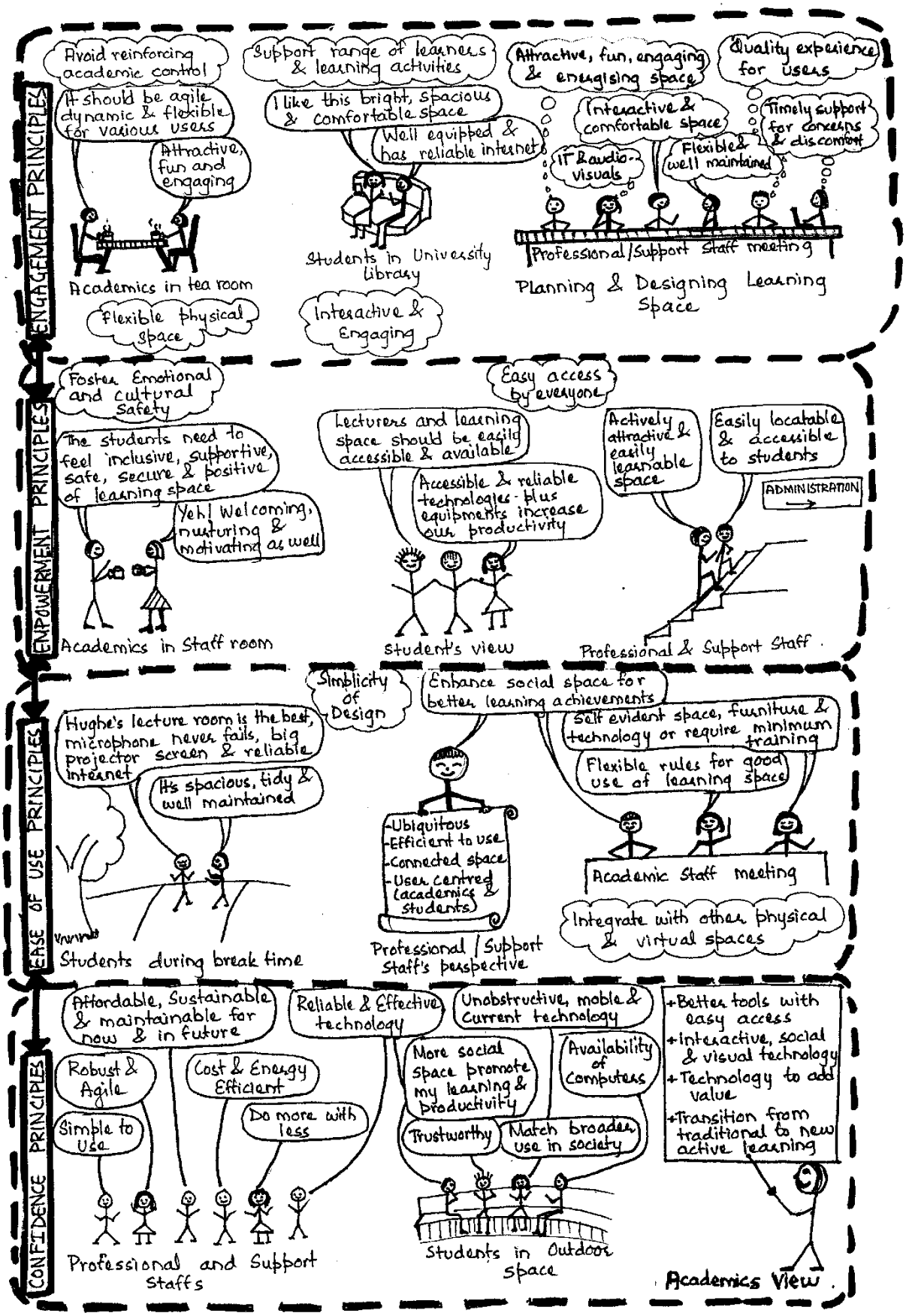

FIGURE 9 - RICH PICTURE REPRESENTATION OF LEARNING SPACE DESIGN PRINCIPLES

CONCLUSIONS

In the end this collection of principles is not unlike some of those previously articulated. Its main strength lies in three aspects of its design. Firstly, the list brings together the different perspectives of those associated with the design, development and ongoing use of learning spaces rather than focusing on any single perspective. Secondly all of the principles are firmly grounded in both the literature and in the practical considerations of the three key stakeholder groups. Thirdly, as a succinct set of principles intended to guide the redevelopment of existing spaces, there is clear evidence as to why these principles might be privileged over others.

Finally, it is not the list of principles per see but how they are applied in interesting, innovative and creative ways to address the cost effective redevelopment of existing learning spaces to support new forms of learning. Finally, it is important to recognize that users change, pedagogies evolve and time stands still for no one – consequently these principles will need to be constantly evaluated and realigned over time.

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