

# The UK Higher Education Learning Space Toolkit: a SCHOMS, AUDE and UCISA collaboration



# Foreword

The UK HE Learning Space Toolkit has been produced by SCHOMS, AUDE and UCISA to help members from all three professional bodies share best practice and work more effectively when creating learning spaces. We would like to thank the numerous colleagues from across the professional associations, and others within the wider higher education community, who have contributed to the production of this Toolkit by sharing their experiences and reviewing content. We hope this Toolkit will serve both as a practical guide and as a source of inspiration in the design of spaces that delight and motivate students, as well as meet their functional needs.

Members of the Standing Conference for Heads of Media Services (SCHOMS) lead and manage a diverse set of educational, technology, media and institutional support services. They give strategic direction to support and promote excellence in teaching and learning practice through the deployment of classroom technology, AV equipment and innovation in the design of learning spaces. [www.schoms.ac.uk](http://www.schoms.ac.uk)

AUDE, the Association of University Directors of Estates, promotes excellence in the strategic planning, management, operation and development of higher education estates and facilities. [www.aude.ac.uk](http://www.aude.ac.uk)

UCISA, the Universities and Colleges Information Systems Association, is a membership organisation representing those responsible for delivering information management systems and technology services in universities, colleges and other institutions. [www.ucisa.ac.uk](http://www.ucisa.ac.uk)



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# Executive summary

This Toolkit provides an overview of learning space design in a higher education context, from the point of view of the professional support services who play a key role in such projects.

## Why should we be interested?

Learning, teaching, and indeed the entire context in which universities operate, has changed significantly during the course of the 21st century. Predictions that virtual learning would signal the death of the university campus have however been wide of the mark. We need look no further than the fact that Coursera, the world's largest MOOC provider, is creating physical learning hubs<sup>1</sup> for evidence that a sense of place remains an important part of the educational experience. Further, the 2014 UK Higher Education Estates Statistics Report notes that investment in the academic estate stood at over £2 billion (a rise of £170 million or 9% over the 2011/2012 figure)<sup>2</sup>.

Universities have recognised the need for investment in both formal and informal learning spaces to support the student experience and this includes the requirement to balance innovative and collaborative spaces with traditional tiered lecture theatres, which are increasingly being adapted to new learning practices and continue to play a useful role in the teaching of large cohorts. We are moving away from desk and chair workspaces to providing a range of types of furnishing and deploying a variety of technologies. We are also seeing a shift in where these facilities are located with the development of more learning hubs and satellites.

This collaboration signals the importance of a cross-professional approach to learning space developments. Such developments, whether new build or refurbishment, are complex projects that tend to happen infrequently and represent a substantial financial investment with a significant lifespan. No one professional group has enough knowledge to make the best decisions alone. This Toolkit is intended to help professionals from these support services to work effectively together and with other stakeholders to deliver outcomes that have a significant transformational effect for their institutions.

## Where does this guidance come from?

Two excellent international resources inspired the creation of the Toolkit. The first, the audio visual design guidelines from the Association for Audio Visual and Education Technology Management (AETM), Australia, contain a wealth of well researched material on integrating AV systems into learning spaces<sup>3</sup>. The second, FLEXspace (the Flexible Learning Environments eXchange), is an open access repository populated with examples of learning space images and related information from institutions worldwide<sup>4</sup>.

1 <http://blog.coursera.org/post/65596539008/introducing-coursera-learning-hubs-global>

2 AUDE (2014) UK Higher Education Estates Statistics Report: [www.aude.ac.uk/documents/aude-he-estates-statistics-report-2014/](http://www.aude.ac.uk/documents/aude-he-estates-statistics-report-2014/)

3 [www.aetm.org/av-design-guidelines](http://www.aetm.org/av-design-guidelines)

4 <http://flexspace.org/>

In turn, the UK HE Learning Space Toolkit explores pedagogical principles and their place in learning space design and considers how universities and colleges might take a truly holistic, institution-wide approach to the development of learning spaces.

The Toolkit has been developed as a collaborative effort by SCHOMS, AUDE and UCISA. The guidance in this Toolkit represents the combined wisdom of a group of core contributors from the three associations.

Most of the contributors have worked in a number of UK universities, and a few have crossed the boundaries of the different professional services. The Toolkit contributors were interviewed by the lead author during the summer of 2015, and also provided additional information and resources.

The Toolkit cites seminal works and reference sources for each of the topics covered. Rather than seek to abridge and synthesise these works, we have given most space to discussion of actual experiences. Thus, this Toolkit is firmly focused on the realities of designing and managing new types of learning space in the current UK higher education context, and on the challenges and rewards to be found in cross-professional working.

## Who needs to read this?

The UK Higher Education Learning Space Toolkit is primarily aimed at **staff who will be the lead for their professional area in a learning space project** and at the **managers of those projects**. Although these staff will be familiar with much of the content for their own areas, learning space development requires a significant level of collaboration and the Toolkit serves to highlight the perspectives of other members of the team. In addition, members of the project team may wish to direct other stakeholders to the key messages and resources at appropriate points in the project.

Successful projects will involve **those responsible for supporting and using the space**. Section 3, Managing a learning space project, will give an idea of what types of decisions are taken at what stage so academics and support professionals can be advised of when their input is expected. Those in an academic or support role will want to understand what types of pedagogy/student activity are being supported. Academic staff may find Section 5, Learning technologies, provokes thought about how the new spaces can support learning practice, whereas central services staff may find that some of the resources in Section 2, Working in partnership, promote new ideas about understanding user needs and developing effective mechanisms to support users in these spaces.

It is important to understand how the design of physical space impacts the learning that happens in the space and the importance of reflecting your institution's educational principles in the build. Such strategic considerations are addressed in Section 1, Building a new pedagogy. The Toolkit encourages a holistic, connected view of the university campus as a place where a continuous flow of formal and informal learning can take place and a strategic steer is needed to ensure that new developments and small scale refurbishments reflect key principles and contribute to overall strategic goals. As mentioned above, learning space projects require a broad range of expertise; Section 2, Working in partnership, will help give an understanding of who needs to be involved in a learning space project and the importance of getting the right people to the table at an early stage. The resources on stimulating creativity will highlight the value to be gained in sometimes departing from established norms to deliver something different and Section 7, Change management and transition, will assist in planning a smooth transition to new ways of working.

Ideally the **strategic champion and project manager** will already have involved **those leading a particular functional area in defining the vision** using the above mentioned resources. Section 4, Effective learning by design, will help develop the detailed brief for the project. The section, in addition to giving guidance for each area of expertise and responsibility will also show how decisions about one aspect of the build can impact elsewhere in the project. With time and budget constraints there will inevitably be hard decisions to take at some points in the project, and understanding how your input fits with the bigger picture can give you confidence that you are taking well informed decisions. There is greater use of techniques such as benefits realisation to demonstrate the impact of project; Section 6, Evaluation, gives examples of how a new space may be assessed to ensure that expected benefits are delivered as well as practical responsibility for some aspects of Section 7, Change management and transition.

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# 1 Building a new pedagogy



## THIS SECTION AT A GLANCE

- we consider the way in which design of physical space impacts the learning that happens in the space;
- we identify current trends in learning and teaching practice;
- we look at the need for a set of guiding principles to inform learning space design.

## Expectations from reading this section

Many of the professionals associated with supporting the design and build of learning spaces do not themselves have a background in teaching and learning practice, nor do they have direct contact with the end users and stakeholders. The result is that we too often build improved versions of what we already have rather than profoundly challenging the assumptions on which learning spaces are designed. Even lecturers may not fully realise the implications of the way in which the built environment constrains the type of activities that may be carried out. The purpose of this section is therefore to give a brief overview of what is generally recognised as current good practice in learning and teaching and to invite those involved in learning space design to start thinking at a very early stage about the type of learning and teaching experiences they would like to create for the future.

In particular we suggest that:

- design decisions should be guided by a set of educational principles and articulating these principles clearly and simply will aid dialogue and understanding between different stakeholders involved in a learning space project;
- we need to design for a diversity of pedagogic approaches bearing in mind a strong prevailing tendency towards a socio-constructivist approach<sup>5</sup> that emphasises participatory and collaborative activities wherever appropriate;
- we need to think about entire campuses as learning spaces and consider the seamless flow of different types of learning activity as well as the overall range of provision.



*“We need to start, then, by asking not ‘what buildings do we want?’ but instead ‘what sort of education do we want to see in future?’. We need to ask not ‘how many classrooms do we need?’ but ‘what sorts of learning relationships do we want to foster? What competencies do we want learners to develop? What tools and resources are available to us to support learning?’” (Rudd et al 2006<sup>6</sup>)*

<sup>5</sup> Socio-constructivism — a pedagogic approach that emphasises the impact of communication, collaboration, and negotiation on thinking and learning. Students are actively involved in their own learning which is a process of peer interaction mediated and structured by a tutor.

<sup>6</sup> Rudd T, Gifford C, Morrison J and Facer K (2006) What if...Re-imagining learning spaces. Futurelab: [www2.futurelab.org.uk/resources/publications-reports-articles/opening-education-reports/Opening-Education-Report128](http://www2.futurelab.org.uk/resources/publications-reports-articles/opening-education-reports/Opening-Education-Report128)

## 1.1 Constructing learning

The title of this section is taken from Monahan's (2002) use of the term *built pedagogy* to refer to "architectural embodiments of educational philosophies"<sup>7</sup>. In other words, the way in which a space is designed shapes the learning that takes place in that space. The design of many of our lecture theatres and traditional classrooms has changed little over hundreds of years. The layout generally predisposes a transmission model whose built pedagogy says that one person will transfer information to others, who will all absorb it at the same rate, by focusing on the person at the front of the room. Similarly, computer labs that do not provide for multiple viewers of a display screen or libraries that do not permit talking convey a built pedagogy contrary to the ideas of social constructivism. This is in stark contrast to prevailing pedagogies that emphasise learning by doing, active learning<sup>8</sup> and problem based learning<sup>9</sup>.

The issue extends beyond formal teaching space to other areas where students spend time. Students spend a lot of transitional time in corridors or outside where they may be obliged to sit on the floor or perch on ledges. Such spaces are not equipped to facilitate learning or interaction and reinforce the message that students do not learn until they move into formal learning space with a lecturer present. The separation of support services and places where staff spend time also creates a distinction that puts the student in a role as a recipient of information rather than a member of a learning community with an ethos of research engaged teaching<sup>10</sup>.

The focus of current thinking about good practice in education puts the emphasis very firmly on learning rather than teaching and sees the learner as a cocreator of knowledge rather than a consumer of transmitted information; our learning spaces need to reflect this.

Another factor significantly impacting the type of learning and teaching that is possible is the ubiquity and accessibility of digital technology. As technology becomes increasingly mobile and affordable it offers new possibilities to design new types of learning activity that encourage students to create as well as consume learning resources and to collaborate in different ways within the physical space. The convergence of the physical and virtual environments is therefore a significant theme throughout this Toolkit.

Whilst it is true that students often want clearly identifiable places, such as libraries, for learning, the constructivist learning paradigm supported by ubiquitous technology leads to a more holistic, connected view of the university campus. Rather than consisting of discrete locations where learning is constrained in time and space, we start to think of the whole campus as a place where a continuous flow of formal and informal learning can take place.



*"Because we habitually take space arrangements for granted, we often fail to notice the ways in which space constrains or enhances what we intend to accomplish."* (Van Note Chism 2006<sup>11</sup>)



*"The question in the future might not be, should we develop alternative learning spaces, but just how damaging to learning are traditional classrooms and lecture theatres?"* (Martin 2010<sup>12</sup>)



*"What made this task difficult was a lack of immediately relevant information. Developments in pedagogic thinking provided much information around teaching practice but seemingly little, by contrast, about the kind of spaces that would support these educational progressions."* (Martin 2010<sup>13</sup>)



*"The emphasis on learning means that we must also think about the learner. Learning spaces are not mere containers for a few, approved activities; instead, they provide **environments for people.**"* (Brown and Long 2006<sup>14</sup>)

7 Monahan, T. (2002) "Flexible Space and Built Pedagogy: Emerging IT Embodiments," *Inventio*, vol. 4, no. 1

8 Active learning is a general term for learning activities that engage students in doing more than simply listening and taking notes. Students participate in activities that promote synthesis, analysis and reflection on course content, encouraging students to take ownership of their learning. It can involve students working either individually on tasks to clarify and internalise their understanding of course content or with others on collaborative activities that motivate each other's learning and reflect on different peer perspectives: <http://bit.ly/cityuniactivelearn>

9 Problem based learning – a student centred pedagogy in which students learn about a subject through the experience of solving an open-ended problem and learning as fundamentally social and grounded in conversation.

10 See Van Note Chism (2006) for a discussion of these issues. Van Note Chism, N. (2006) *Challenging traditional assumptions and rethinking learning spaces* in Oblinger, D.G. (ed) *Learning Spaces*. Washington DC: EDUCAUSE: [www.educause.edu/research-and-publications/books/learning-spaces](http://www.educause.edu/research-and-publications/books/learning-spaces)

11 Van Note Chism, N. (2006) *Challenging traditional assumptions and rethinking learning spaces* in Oblinger, D.G. (ed) *Learning Spaces*. Washington DC: EDUCAUSE: [www.educause.edu/research-and-publications/books/learning-spaces](http://www.educause.edu/research-and-publications/books/learning-spaces)

12 Martin, P. (ed) 2010 *Making space for creativity*. University of Brighton: [http://about.brighton.ac.uk/creativity/Library/UofB\\_msfc-ebook\\_FINAL.pdf](http://about.brighton.ac.uk/creativity/Library/UofB_msfc-ebook_FINAL.pdf)

13 Martin, P. (ed) 2010 *Making space for creativity*. University of Brighton: [http://about.brighton.ac.uk/creativity/Library/UofB\\_msfc-ebook\\_FINAL.pdf](http://about.brighton.ac.uk/creativity/Library/UofB_msfc-ebook_FINAL.pdf)

14 Brown, M. and Long, P.D. (2006) *Trends in learning space design* in Oblinger, D.G. (ed) *Learning Spaces*. Washington DC: EDUCAUSE: [www.educause.edu/research-and-publications/books/learning-spaces](http://www.educause.edu/research-and-publications/books/learning-spaces)

## 1.2 A principle led approach

Whilst in the following sections we look at recognised design standards for certain aspects of learning spaces (e.g. audio visual equipment) there is no formula that will allow you to design a successful learning space to support your particular institutional mission. You will be bringing together a mixed group of stakeholders (most of whom may be doing this for the first time) in order to design for an unpredictable future. In the case of a major building project, many of the technologies that are currently state of the art will be outdated by the time the build is complete. In this scenario the best starting point is to identify a clear educational purpose and a set of principles that will guide your design decisions and allow for new and updated ideas to be included in the infrastructure.

There are numerous published examples of design principles. Many of them are based on Chickering and Gamson's (1987) seven principles of good practice in undergraduate education as translated into space design<sup>15</sup>:

1. Encourages contacts between students and staff;
2. Develops reciprocity and cooperation among students;
3. Uses active learning techniques;
4. Gives prompt feedback;
5. Emphasises time on task;
6. Communicates high expectations;
7. Respects diverse talents and ways of learning.

Jisc (2006)<sup>16</sup> outlines a very simple set of principles, that space should be:

- **Flexible** – to accommodate both 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.

Agreeing the principles that should underpin learning space design in your particular context may be no easy matter. The principles will need to gain widespread support. However, if they are to enhance your learning and teaching practice they will need to be articulated in a way that challenges the *status quo* and demands positive action on the part of those using the space. You will need to think very carefully about how the principles will be put into practice. In the Viewpoints below you will find a number of observations on the meaning and value of terms such as *flexibility*.

The following set of design principles has been loosely adapted for this Toolkit from the work of Lomas and Oblinger<sup>17</sup>. We propose that learning spaces should:

### Create a sense of community and encourage participation

Learning is above all a social process. The physical environment of a university should create a sense of being part of a learning community. It should support people learning together through providing physical spaces for collaboration and the possibility of connecting digitally to a wider community, for example through video or desktop conferencing and webinars. The possibility to observe others at work helps create a sense of connectedness, and the existence of

15 Chickering, A. W. and Gamson, Z. F. (1987) *Seven Principles for Good Practice in Undergraduate Education*. American Association for Higher Education: [www.lonestar.edu/multimedia/SevenPrinciples.pdf](http://www.lonestar.edu/multimedia/SevenPrinciples.pdf)

16 Jisc (2006) *Designing spaces for effective learning: a guide to 21st century learning space design*: <http://www.webarchive.org.uk/wayback/archive/20140616001949/http://www.jisc.ac.uk/media/documents/publications/learningspaces.pdf>

17 Lomas, C. and Oblinger, D.G. *Student Practices and Their Impact on Learning Spaces in Oblinger, D.G. (ed) Learning Spaces*. Washington DC: EDUCAUSE: [www.educause.edu/research-and-publications/books/learning-spaces](http://www.educause.edu/research-and-publications/books/learning-spaces)

social space fosters peer to peer and staff student interactions where much of the real learning is consolidated. We need to create an environment where students construct and cocreate knowledge as well as consume it.

### Integrate and connect learning

A well designed campus allows seamless integration between different types of learning activity: between formal and informal learning and between group and individual learning. The way in which different discipline areas are colocated can encourage interdisciplinary collaboration and students in different years or subjects working in the same space can offer peer mentoring and new avenues for research. Integration of services into the areas where students spend most time can provide better support for the learning experience. Integration of physical and virtual learning resources and activities needs to be considered as part of overall space design. The way in which the physical space integrates the university into its wider context is also important — this can involve the relationship with local landmarks, the ways in which the local community might access the campus and the relationships with business and enterprise such as start-up hubs.

### Meet a range of different learning needs

Well designed learning environments offer facilities that are appropriate for the needs of the institution's learners and spaces that can be adapted to meet a variety of different learning requirements. Furniture which is easily configurable, controllable lighting and portable technologies all have a part to play and *low tech* user-friendly tools have their place alongside digital technologies. Physical space should not constrain the types of learning activity that can be supported and we need to keep future needs in mind, but we cannot demand that all space should be *flexible* because of the difficulty in defining what we might want to achieve by this (see the Viewpoints below and Section 4, Effective learning by design).

### Offer a comfortable working environment

Discomfort is a great distraction to learning. Heat and cold, noise and levels of natural and artificial lighting should all be carefully regulated. Seating should take into account different body sizes, accessibility requirements and the long periods of time students sit without moving. Adequate surfaces for writing and supporting computers, books, and other materials are also required: the small, sloping surfaces on most standard tablet arm chairs are inadequate for these purposes. Current trends in integrating learning and social space bring their own set of issues, not least the transmission of noise and odours from hot food from social spaces into more formal study areas, so zoning and differentiation needs to be carefully thought through. Beyond these functional requirements we also need to think about how to create an appropriate ambience for each space so that students want to spend time there. University planners look to create a *sticky campus* by creating the right environment to retain students through the day. This might mean looking at factors such as extending coffee shop hours on campus and providing adequate space to store personal possessions like bags and coats.



Photo 1: These booths give a private feel for small group work in a large open reception area at the University of Brighton.

Andy Weekes/ © University of Brighton



Photo 2: Group and individual study spaces, Queen Margaret University.

CC-BY-SA-2.0 Aspire-edu

## Offer support

Locating support desks and resilient help systems where students (and staff) are, rather than just where the unit's home base is found, encourages use, as does enabling online support. Both staff and students may need support in maximising the potential of innovative types of learning space. Whilst we stress the importance of ensuring that learning spaces are easy and intuitive to use, the Learning Landscapes project<sup>18</sup> found that, without support, there is a tendency to revert to traditional practices even in the most innovative pedagogic environments. Support should also include assistance to teaching staff to upgrade and digitise teaching resources to suit new environments.

## Make effective use of technology

For students whose world is digital, connected, immediate, social and participatory, access to a wireless network is essential. The students' world is not just the physical one in which they find themselves; it is also the virtual one in which they chat with friends, meet people, share digital content, and explore new ideas. Since learning can occur any place and at any time, there are few, if any, locations where wireless is not valuable.

As students consume information in multiple formats and interact with information by modifying it or sharing it, this activity places additional demands on the network. During peak periods, student use may saturate the wireless network. Having institutional devices with wired connections available as well is part of the answer but the wireless network needs to be designed to cater for continuing growth in demand.

Most students own a variety of technologies such as laptops, smartphones, MP3 players, tablets and more. As technology becomes more ubiquitous and affordable, institutions will find opportunities to deliver information and services in multiple formats and to multiple devices. Convenience is a priority for students, so ensuring that any space can be a learning space by delivering information to personal, handheld devices is important. Approaches to service delivery must however include consideration for those who may not personally own such devices.

Regardless of the technology students use in learning spaces, they will need power (this includes sockets as well as USBs and wireless charging): all devices have a limited battery life, and space planners must take this requirement into account.

## Be inclusive and sustainable

Learning spaces need to support the needs of a diverse learner population. Designing for maximum inclusivity in the first place can avoid costly alterations later. These requirements, if not fully understood by the project manager for example, can easily be value engineered<sup>19</sup>. As well as considering the needs of disabled students and staff, you will also need to think about student perceptions of the campus as a safe environment and the extent to which you provide a welcoming and comfortable environment for international students. Sustainability is high on the agenda for many universities and good design can help minimise environmental impact as well as ensuring that facilities have an acceptable lifespan without the need for extensive maintenance.

## Involve, inspire and motivate students

Students will most likely spend more time in campus learning spaces than anyone else and they have a valuable perspective on what works and what does not. Finding meaningful ways to involve students in planning and evaluating space design is an effective way to ensure that the space catalyses learning. As well as simply supporting their learning we should aim for a vision that the space is inspiring and motivating for students. Seeking to delight students should be one of our core aims.



*"Students should be at the heart of every project and although students are ephemeral by the very nature of study cycles, the student body is the constant."* Caroline Pepper



*"Flexibility often just means lazy thinking. The term is used by academics who haven't thought through the realities of different types of learning activities. Flexibility can introduce a lot of issues: it boils down to trying to be Jack of all trades and being master of none."* James Rutherford



*"All learning spaces need to reflect the particular institutional context. Often people go to visit spaces and copy them exactly then find it doesn't work for them as it doesn't reflect their university."* Toni Kelly

<sup>18</sup> Neary et al (2010) *Learning landscapes in higher education*. University of Lincoln: <http://learninglandscapes.blogs.lincoln.ac.uk/files/2010/04/FinalReport.pdf>

<sup>19</sup> Value engineering: [https://en.wikipedia.org/wiki/Value\\_engineering](https://en.wikipedia.org/wiki/Value_engineering)



## VIEWPOINT

**James Rutherford, Learning Spaces Development Manager, University of Birmingham**, has undertaken research into learning space design with a particular emphasis on collaborative learning and there is more information about this research on his blog<sup>20</sup>.

James believes that underpinning educational principles can help link a learning space strategy into the learning and teaching strategy in a meaningful way. *“Principles are more effective than strategy. Strategy can be a bit fluffy in some people’s minds: it’s something that you have to say and it doesn’t really mean anything. Principles are more tangible and more effective for people who you want to engage with this”*. James is clear that strategy needs to make sense in terms of what is happening on the ground: at Birmingham there is increasing emphasis on enquiry based learning and independent learning and James feels this Toolkit can be useful in helping to flesh out what that looks like in practice.



## VIEWPOINT

**Bruce Rodger, Head of Infrastructure, University of Strathclyde**, tells us that when it comes to designing for particular types of learning activity the notion of flexibility is a personal bugbear for him. *“When people say they want flexibility and you ask them exactly how it should flex they don’t know. Flexibility always involves compromise and sometimes you break what it was meant to do in the first place”*.

An example of this is a flexible space that was designed with a movable partition in the centre so that it could be used as one large room or two small rooms. In practice its normal use is as two small rooms and it is very rarely used as a large room. The existence of the partition however means that noise transmission is a problem, the audio visual (AV) control system is overly complicated and there are two walls that cannot be used for hanging anything.

Another example is a large auditorium that can also be transformed into three smaller theatres. This was felt to be particularly suitable for use by the conference trade. However, changing from one configuration to another takes two people almost an hour, a limitation that was not obvious when the designs were being presented.

The guidance that Bruce would give to others is that you need to decide what you need each room to do and do that really well and then see what else can be accommodated. He feels that **adaptability** is a much more pragmatic approach than flexibility. It is quite practical to design a room to be adaptable between two or three defined states. A fully flexible approach requires a lot of support available at certain changeover times. For Bruce, an often repeated phrase rings true: *“Flexibility is the F word in learning space design”*.



## VIEWPOINT

**Sally Jorjani, Head of Academic and Business Liaison, Edinburgh Napier University**, has found that the creation of some new social learning spaces has improved staff student interaction. Sally told us that at her university most academic staff are based in two to three person offices so they find it difficult to talk to students in their office as they worry about disturbing their colleagues. Whilst evaluating the new spaces Sally heard from one lecturer, who is delighted with the new facilities, that interaction has greatly improved, whilst a student has commented “I really like the high ‘sofas’ as they provide groups with another option to do a project”.

<sup>20</sup> <http://learningenvironmentdesign.net/>



## VIEWPOINT

**Eleanor Magennis, Head of Space Planning, University of Glasgow**, is a qualified architect who works within the Estates and Buildings Department at the university. Eleanor feels fortunate that her first learning space project (in a previous role at the University of Strathclyde) was a teaching cluster driven by the desire to implement an active learning approach. She worked with a fantastic academic champion and had students involved from the beginning which gave her very good insight into teaching and learning practice. This experience has shaped Eleanor's views about how universities need to work with architects to ensure that they understand the educational context. She sees a key role for this Toolkit as supporting architects to see how *learning is changing and also to understand the impact of technology on how students learn*. Without this kind of support Eleanor says projects will simply *“deliver what has always been done”*.

Eleanor suggests that a good way to approach any learning space project is to start with graduate outcomes and ask what skills do you want students to gain; how does teaching support this and how does the space support this? This forces you to think about the pedagogic approach and define the kind of space that can support the required activities. It is a good way to engage academics and show you are asking the right questions and talking their language. Eleanor recommends that *“Having a good academic champion is crucial. They drive the project through. They are focused on the pedagogy and they take account of the student voice and bring that in”*.

## Resources

- FLEXspace (the Flexible Learning Environments eXchange) is an open access repository populated with examples of learning space images and related information from institutions worldwide<sup>21</sup>.
- City University has produced a short video for tutors detailing a range of new learning spaces and the types of activity to which they are suited (particularly active and collaborative learning)<sup>22</sup> and a series of blog posts on activities that can be done in flexible and non-flexible spaces<sup>23</sup>.
- The Australian Learning and Teaching Council has an excellent website, Retrofitting University Learning Spaces, that looks at principles underpinning effective learning spaces and tips for putting the principles into practice<sup>24</sup>.
- James Cook University in Australia has produced a website called Learning Spaces Snapshots that has a collection of short videos showing how different pedagogic approaches are put into practice in different types of learning space<sup>25</sup>.
- McGill University, Canada: Principles for designing teaching and learning spaces<sup>26</sup>.
- The Pedagogy, Space, Technology (PST) Framework developed by the University of Queensland provides a design and evaluation framework to help learning space project teams reflect on what they are doing and why<sup>27</sup>.

21 <http://flexspace.org/>

22 [www.youtube.com/watch?v=sAVtiuHCfCM](http://www.youtube.com/watch?v=sAVtiuHCfCM)

23 <http://bit.ly/cityuniactivelearn>

24 <http://learnline.cdu.edu.au/retrofittingunispace/>

25 <https://sites.google.com/site/jculearningspaces/home>

26 Finkelstein, A., Ferris, J., Winer, L. and Weston, C. (2014). *Principles for designing teaching and learning spaces*. Montreal: Teaching and Learning Services, McGill University: [www.mcgill.ca/tls/files/tls/principles\\_for\\_the\\_design\\_of\\_teaching\\_and\\_learning\\_spaces\\_2014\\_f.pdf](http://www.mcgill.ca/tls/files/tls/principles_for_the_design_of_teaching_and_learning_spaces_2014_f.pdf)

27 University of Queensland (2009) *Learning Spaces in Higher Education: Positive Outcomes by Design*. Proceedings of the Next Generation Learning Spaces 2008 Colloquium: [www.uq.edu.au/nextgenerationlearningspace/proceedings](http://www.uq.edu.au/nextgenerationlearningspace/proceedings)

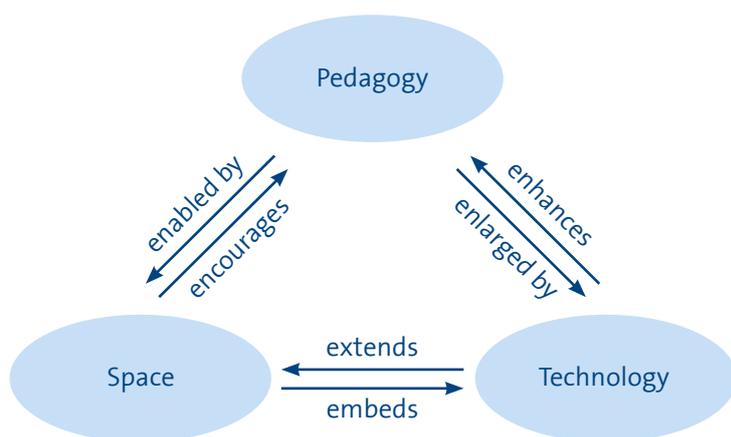


Figure 1: A Pedagogy-Space Technology (PST) Framework for Designing and Evaluating Learning Places (D. Radcliffe), University of Queensland. Creative Commons License (Attribution-Noncommercial-ShareAlike 2.5)<sup>28</sup>.

28 University of Queensland (2009) *Learning Spaces in Higher Education: Positive Outcomes by Design. Proceedings of the Next Generation Learning Spaces 2008 Colloquium*: [www.uq.edu.au/nextgenerationlearningspace/Chapter1.pdf](http://www.uq.edu.au/nextgenerationlearningspace/Chapter1.pdf)

## 2 Working in partnership



### THIS SECTION AT A GLANCE

- we identify the need for learning space projects to involve a wide range of stakeholders from an early stage;
- we discuss a model for the type of engagement a project wants to achieve;
- we look at some techniques for gaining effective stakeholder participation.

### Expectations from reading this section

Professionals charged with leading a learning space project may be required to work with a range of stakeholders across functional areas that are outside their day to day experience. This Toolkit has a focus on helping those with responsibility for the management of the university estate, IT infrastructure and audio visual support work effectively together but a successful project will need to involve a much wider range of stakeholders.

Each of these stakeholders may have very different perspectives on the project and understanding and reconciling these views takes time. A strong desire to meet deadlines and manage a tight budget may encourage project leaders to want to get on with the build and solve any outstanding issues later. This section is intended to highlight the importance of ensuring that stakeholder voices including academics, students and support staff are heard and acted upon from the beginning of the project if costly mistakes are to be avoided.

In particular we suggest that:

- project teams should be aiming for highly participatory approaches to stakeholder engagement rather than token information giving;
- designers should be looking to stimulate creative thinking if we are to go beyond simply creating new versions of what we already have;
- there are many simple approaches that can be used effectively to help stakeholders understand one another's viewpoints and work collectively to make better decisions.



*We cannot design effective spaces for learning unless we recognize that many stakeholders hold a valuable piece of the puzzle - their input is essential. (Bickford and Wright 2006<sup>29</sup>)*

<sup>29</sup> Bickford, D. J., and Wright, D. J. (2006) *Community: The Hidden Context for Learning Spaces in Oblinger, D.G. (ed) Learning Spaces*. Washington DC: EDUCAUSE: [www.educause.edu/research-and-publications/books/learning-spaces/](http://www.educause.edu/research-and-publications/books/learning-spaces/)

## 2.1 Getting the right people to the table

The stakeholders involved in a learning space project can be viewed as part of a university ecosystem. In broad terms the framework of this ecosystem looks something like this:

Strategy level	A learning spaces strategy founded on sound educational principles, linked to the learning and teaching strategy and preferably also embedded in the estate strategy. An academic lead who will champion each individual project.
Management level	The central professional services who will be responsible for delivering individual projects.
Practitioner level	Individual academics and students who participate in working groups etc. for individual projects and who are ultimately the end users of the space. Support staff who deliver services in or to the learning space.

Thinking in these terms is a starting point towards knowing who needs to be involved; although the simplified framework does not cover all stakeholders. An example list of stakeholders for a learning space project includes those who play a role in:

- studying, using the space, often over an extended day;
- academic leadership (this may be discipline specific or related to generic space);
- teaching, or some form of guided learning, in the space;
- managing the fabric of the buildings;
- managing the IT and electrical infrastructure;
- learning support including audio visual support;
- timetabling the space;
- providing learning resources;
- providing technical support in the space;
- providing other forms of student support in or related to the space;
- cleaning, setup and maintenance of the space;
- security of the space;
- health and safety in the space;
- financing the project and recurrent costs;
- supporting the project as an external specialist;
- events and conferences;
- student and academic services events (such as career fairs).

This initial list highlights a critical point: the complexity of learning space projects defies the ability of any one perspective to capture all of the necessary requirements and absorb enough information to make informed decisions. A learning space project demands a team approach and that means cross-functional working by academic and support services and the active participation of learners themselves. For many of the stakeholders it will be their first experience of this type of project (indeed a major new build or refurbishment is often a once in a career experience) and every project is unique. Effective engagement with all of these stakeholders is essential to the success of the project.

For the Loughborough Design School (with Burwell Deakins Architects), the vital principles for a collaborative project included: getting stakeholders on board who believed in progress; identifying project champions to promote the idea; creating a team that would actively engage and ensuring there was a fallback position or a *plan B*.

A number of contributors to this Toolkit felt that AV and IT people are often brought into projects too late in the day. Eleanor Magennis certainly thinks they need to be brought in earlier and the timing of their involvement will be affected by whether the project is refurbishment or new build: *“The best of them aren’t just delivering something; they are contributing to what is possible”*.

Not only is it vitally important to get the right people around the table, but also everyone needs to understand each other and not leave things to be misinterpreted or misunderstood. A common language is needed so that if a *flexible* space is being developed, then everyone has, and understands, the same definition of *flexibility* in this context.

These are some of the things Toolkit contributors told us about working together and wider stakeholder engagement:

- A challenge many stakeholders have is simply getting to the table.
- People often don’t consult students at all.
- Communication is always a big issue. It can be good at the start then fall away.
- You need to communicate several times even if you are saying the same thing over and over again.
- Concerns are often brought to the table too late when decisions have already been made.
- People deliberately exclude AV because they know it will be expensive but it actually costs more to get it right later.
- Project boards can be very large or very formal; people are often afraid to contribute in these circumstances.
- Project board meetings can often have quite an aggressive atmosphere.
- Students are valuable in that they will state the obvious whereas other people might be too concerned about their own jobs and roles.
- You need to take stakeholders through it many times and ask them to relay it back to you so that you are sure they understand.
- You need to keep in mind the most significant things that you need to deliver. A one page summary that you keep going back to can be useful to focus you on the core things.
- Academics explaining the space to other colleagues is much better than it coming from Estates.
- Meeting in the actual space when and where possible is always helpful when discussing a range of details.
- When meeting with construction teams, there needs to be a clear understanding of what has been agreed at every point before moving onto the next item.



*“...the process was made smoother by a flexible and professional estates department working hard to deliver the pedagogic vision. Where elements of the vision were lost these were due to safety or budgetary reasons rather than intransigence or taking of easier options.” (Martin 2010<sup>30</sup>)*



*“Even though all of the departments involved were on the project team, the information didn’t always filter down to the people who actually had to do the work.” Toolkit contributor*

## 2.2 Managing participation

It is important to determine exactly what level of engagement the project is aiming to have with each of its stakeholder groups in order to design and implement an effective strategy for ensuring such engagement.

A useful starting point may be the concept of a *ladder of participation* which has been widely used and adapted in many contexts since it was first conceived by Arnstein<sup>31</sup> in 1969. The simplified version shown below has been adapted from work at Birmingham City University<sup>32</sup>.



Figure 2: A representation of Birmingham City University's adaptation of Arnstein's (1969) Ladder of Participation.

Although the ladder is hierarchical, in as much as the degree of participation increases on each rung, it is not necessarily always appropriate or desirable to aim for the highest level of participation in every project. A learning space project requires a degree of central coordination which means it would be unrealistic to expect that stakeholders would take full ownership of the project and self-organise. On the other hand, stakeholder participation is vitally important to the success of the project and it is important to avoid tokenism where stakeholders are simply informed about decisions already taken or where the project team does not hear, and fully understand, a sufficiently wide range of views to make appropriate decisions. Learning space projects are therefore likely to operate at the upper end of the ladder.



*"Inviting people with different perspectives to contribute to collective decision making can be time-consuming in the development phase but ultimately is less time-consuming than leaving them out."* (Bickford and Wright 2006<sup>33</sup>)

The table below looks in a little more detail at each of the approaches and the means that might be used to achieve this level of engagement. The project team also needs to be clear about whether it is aiming to achieve the same degree of participation from all stakeholders or whether there are distinctions to be made between various categories of stakeholder.

31 Arnstein, S.R. (1969): A Ladder Of Citizen Participation, *Journal of the American Institute of Planners*, 35:4, 216: [www.tandfonline.com/doi/abs/10.1080/01944366908977225](http://www.tandfonline.com/doi/abs/10.1080/01944366908977225)

32 <http://jiscdesignstudio.pbworks.com/w/page/27046505/T-SPARC%20Stakeholder%20Engagement%20Model>

33 Bickford, D. J., and Wright, D. J. (2006) *Community: The Hidden Context for Learning Spaces* in Oblinger, D.G. (ed) *Learning Spaces*. Washington DC: EDUCAUSE: [www.educause.edu/research-and-publications/books/learning-spaces/](http://www.educause.edu/research-and-publications/books/learning-spaces/)

Level of engagement	Characteristics of approach	Means of engagement
6. Empower	Stakeholders set the agenda for change and self-organise/manage	Not generally applicable for this type of project
5. Collaborate	Decisions taken in partnership with stakeholders	Stakeholder-led consultation. Stakeholders on Steering Group
4. Involve	Joint working to ensure views are heard and understood. Decision making still largely in hands of project team	Jointly led workshops/focus groups/voting
3. Consult	Agenda largely framed by project team. Stakeholder views actively solicited	Workshops/focus groups/interviews/surveys led by project team
2. Inform	Stakeholders are regularly provided with contextualised information and made aware of means of participating in the project. Dialogue is implicitly welcomed	Blog with comment facility/ mailing list/use of Twitter
1. Notify	Stakeholders are passive recipients of (largely un-contextualised) information	Static web pages/minutes made available/untargeted publicity

### 2.3 Creative thinking for a different future

One of the most difficult aspects for many stakeholders in a learning space project is being able to envisage spaces that are very different from where they were taught and where they have spent much of their working lives. It is easy to imagine existing spaces that are brighter and better furnished but less so to develop a blueprint for a radically different type of learning experience. This can apply equally to architects whose experience of higher education may have been a relatively traditional one: they can design architecturally stimulating buildings but they will need a lot of input from your staff and students to make them work as learning spaces for the 21st century. Bruce Rodger, Head of Infrastructure, University of Strathclyde, emphasises the need for your institution to think about its own vision and what it wants to achieve before it employs external advisors: *“Sometimes architects get involved slightly too early in the process. We need to think carefully about the fundamental uses of the space before design concepts get cast in stone”*.

The good news is that creative thinking is a skill that can be developed, and there are many techniques to aid this, such as the Learning Space Canvas<sup>34</sup>:

<sup>34</sup> This graphic-free version of *The Learning Space Canvas* is reproduced by kind permission of Prof Robert Fitzgerald, INSPIRE Centre, University of Canberra. The original can be found here: <http://bit.ly/learningspacecanvas>

# Learning Space Canvas

## Step 1 - WHAT

### Context

A designed approach to prototyping learning environments that work for teachers and students.

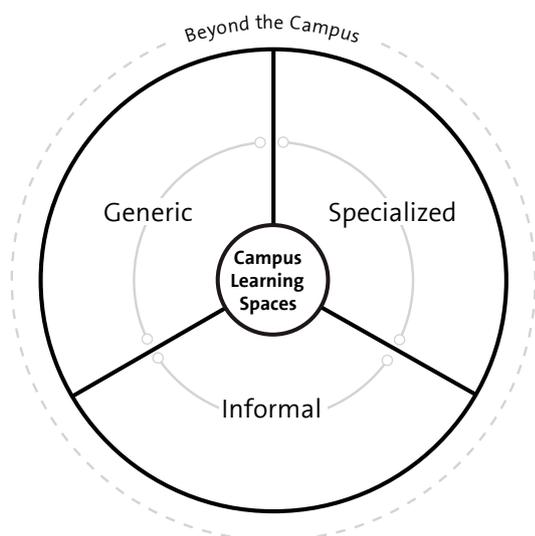
#### Aim

Develop a new or retro-fitted learning environment suitable for the next five years (2015-20).

- Apply a design thinking approach to mapping and prototyping existing, new and imagined learning environments.
- Conduct a gap analysis to examine spaces from multiple perspectives.
- Develop a value proposition based on the SOLO taxonomy work of Biggs (1982, 2007).
- Actively explore how to evolve your institution's learning environments to support student outcomes.
- Compete for the Grand Prize!

#### Let's get started. Build a campus environment map

- List your existing campus facilities (use post-it notes and the framework provided).
- Think 'beyond the campus' and list spaces where students might be involved with curriculum specific learning (use the outer circle).



#### Find the Gap

- Tag/mark the post-it notes with how you might use the space (use the colour from the verbs below)
- Identify any gaps/opportunities

Single Point	Multiple Point	Logically Related	Unanticipated Extension
Choose Identify Label Listen Match Name Note Quote Recall Recognise Review Select State Tell Transmit	Arrange Clarify Define Describe Duplicate Examine Explain Extend Interpret List Order Rearrange Revise Rework Schedule Separate Solve Symbolise	Analyse Apply Appraise Categorise Classify Combine Contrast Demonstrate Design Discuss Distinguish Evaluate Illustrate Inquire Map Observe Outline Perform Plan Predict Relate Summarise	Appreciate / deep understanding Articulate Assess Create Debate Develop Elaborate Generate / develop Hypothesise Imagine Infer Initiate Judge Originate Reflect Synthesise Theorise Validate Value / judge Visualise

## Step 2 - SO WHAT

### Significance

Dig deeper

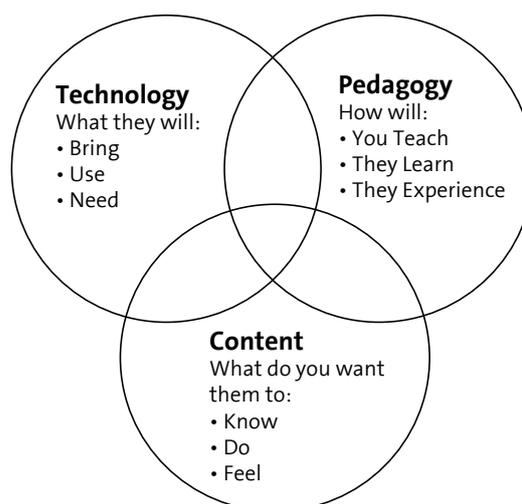
#### Summarize your proposed space

- Name
- Purpose
- Key tech
- Audience

#### TPACK Health Check

Consider your potential space and make a few notes against each question below (Technology, Pedagogy & Content Knowledge)

Remember we are looking for a balance in the TPACK framework.



#### Review

On the scales below describe the attributes of your space. (Add more if required)

Questions	Scale
Group size	small <input type="radio"/> large
Boundary control	none (open plan) <input type="radio"/> total (walled/closed)
Technology provision	basic (wifi, power) <input type="radio"/> advanced (kitchen sink)
Ability to reconfigure space	fixed <input type="radio"/> flexible
Ambience	formal <input type="radio"/> informal
Light	bright <input type="radio"/> dark
Sound	noisy <input type="radio"/> quiet
	<input type="radio"/>
	<input type="radio"/>

Figure 3: The Learning Space Canvas (graphic-free version)

Team Name: \_\_\_\_\_

**Step 3 - WHAT NEXT**

**Action**

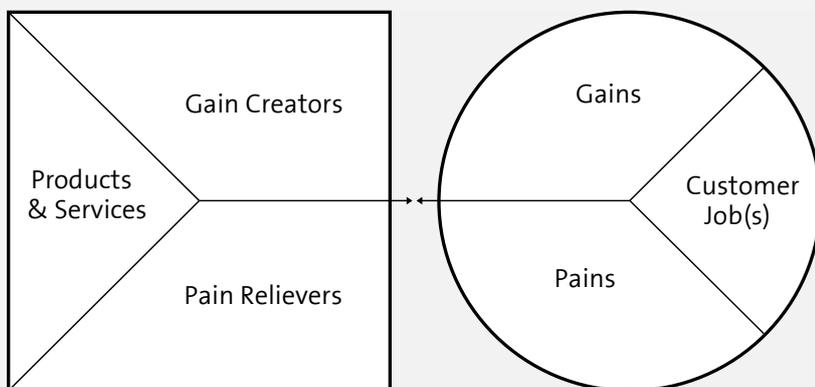
*Develop your idea*

**Business Model Generation Canvas**

<p><b>Key Partners</b></p> <p>Who are our Key Partners? Who are our key suppliers? Which Key Resources are we acquiring from partners? Which Key Activities do partners perform?</p> <p><b>motivations for partnerships:</b> Optimization and economy Reduction of risk and uncertainty Acquisition of particular resources and activities</p>	<p><b>Key Activities</b></p> <p>What Key Activities do our Value Propositions require? Our Distribution Channels? Customer Relationships? Revenue streams?</p> <p><b>categories</b> Production Problem Solving Platform/Network</p>	<p><b>Value Propositions</b></p> <p>What value do we deliver to the customer? Which one of our customer's problems are we helping to solve? What bundles of products and services are we offering to each Customer Segment? Which customer needs are we satisfying?</p> <p><b>characteristics</b> Newness Performance Customization "Getting the Job Done" Design Brand/Status Price Cost Reduction Risk Reduction Accessibility Convenience/Usability</p>	<p><b>Customer Relationships</b></p> <p>What type of relationship does each of our Customer Segments expect us to establish and maintain with them? Which ones have we established? How are they integrated with the rest of our business model? How costly are they?</p> <p><b>examples</b> Personal assistance Dedicated Personal Assistance Self-service Automated Services Communities Co-creation</p>	<p><b>Customer Segments</b></p> <p>For whom are we creating value? Who are our most important customers?</p> <p><i>Mass Market Niche Market Segmented Diversified Multi-sided Platform</i></p>
	<p><b>Key Resources</b></p> <p>What Key Resources do our Value Propositions require? Our Distribution Channels? Customer Relationships? Revenue Streams?</p> <p><b>types of resources</b> Physical Intellectual (brand patents, copyrights, data) Human Financial</p>		<p><b>Channels</b></p> <p>Through which Channels do our Customer Segments want to be reached? How are we reaching them now? How are our Channels integrated? Which ones work best? Which ones are most cost-efficient? How are we integrating them with customer routines?</p> <p><b>channel phases:</b></p> <ol style="list-style-type: none"> <li><b>Awareness</b> <i>How do we raise awareness about our company's products and services?</i></li> <li><b>Evaluation</b> <i>How do we help customers evaluate our organization's Value Proposition?</i></li> <li><b>Purchase</b> <i>How do we allow customers to purchase specific products and services?</i></li> <li><b>Delivery</b> <i>How do we deliver a Value Proposition to customers?</i></li> <li><b>After sales</b> <i>How do we provide post-purchase customer support?</i></li> </ol>	
<p><b>Cost Structure</b></p> <p>What are the most important costs inherent in our business model? Which Key Resources are most expensive? Which Key Activities are most expensive?</p> <p><b>is your business more:</b> Cost Driven (leanest cost structure, low price value proposition, maximum automation, extensive outsourcing) Value Driven (focused on value creation, premium value proposition)</p> <p><b>sample characteristics:</b> Fixed Costs (salaries, rents, utilities) Variable costs Economies of scale Economies of scope</p>		<p><b>Revenue Streams</b></p> <p>For what value are our customers really willing to pay? For what do they currently pay? How are they currently paying? How would they prefer to pay? How much does each Revenue Stream contribute to overall revenues?</p> <p><b>types:</b> Asset sale Usage fee Subscription Fees Lending/Renting/Leasing Licensing Brokerage fees Advertising</p> <p><b>FIXED PRICING:</b> List Price Product feature dependent Customer segment dependent Volume dependent</p> <p><b>dynamic pricing:</b> Negotiation/bargaining Yield Management Real-time-Market</p>		

**Resources**  
Business Model Generation - <http://www.businessmodelgeneration.com/canvas/bmc>

**Value Proposition Canvas**



**Resources**  
Value Proposition Canvas - <http://www.businessmodelgeneration.com/canvas/vpc>  
A full set of workshop resources are available at <http://www.inspire.edu.au/ngls>



The use of metaphor can be helpful in getting stakeholders to take an entirely fresh look at the idea of a learning space and the facilities, activities and relationships between them. At Glasgow Caledonian University the development of the Saltire Centre used metaphors such as the ground floor being a city and market place, the first floor, which has three entrances and exits being an airport departure lounge, and other quieter floors using domestic garden and living room metaphors. At the University of Birmingham the metaphor of a tree growing through a building was used to stimulate ideas about taking the inside out and bringing the outside in. At Loughborough University the consultation process for the Design School lecture theatre included a workshop where the participants including the Pro-Vice Chancellor (Teaching) used Play-Doh to create a metaphor.

This example of using a metaphor has been loosely adapted from the work of Martin (2010)<sup>35</sup> on creativity:

Invite your stakeholders to think about a suitable metaphor for the learning space and list the kinds of activities this brings to mind. For example they might choose a garden and list the kinds of things you can do with a garden such as:

- watch it and see what happens;
- dig it all up and start afresh;
- explore it, weed it a bit, tidy up;
- add things, remove things, replace things;
- build walls and fences;
- make paths;
- re-organise, make new groups, move things around;
- grow a variety of flowers, vegetables, fruit;
- listen to the birds and bees;
- lie back in the sun and contemplate;
- have a barbecue;
- frame the view, modify the view.

Next invite them to apply the metaphor to the real situation and *force fit* the garden ideas to a learning space. What are the implications for the space? Some examples might include:

- Dig it all up and start afresh. Do we risk taking away a valuable habitat or important part of the ecosystem? What kind of unwanted weeds will spring up again if we do not do enough maintenance?
- Build walls and fences. Is it useful to have walls and fences around areas of learning? Is this essential zoning or a barrier to connected learning? Can we remove the fences or avoid them if we want to? Do we need gates, doors, openings?
- Make paths. Connect things; put in stepping stones. Think about how the direction of the paths affects the view and ease of carrying out jobs at different times of the year.
- Grow a variety of flowers, vegetables and fruit. How do we make the ground fertile for different types of learning?

There are all sorts of further possibilities for the initial idea of a garden, such as: make a pond, encourage trees, build a sandpit, put up a swing... No two groups will ever come up with the same response to this type of question but it can be very valuable in looking at things in a different way that is not constrained by our particular professional perspectives.

The University of Birmingham has also used Pinterest<sup>36</sup> as a means of supporting widespread stakeholder engagement. Pinterest is a virtual mood board and collaboration space that the university used in initial design meetings to help in creating the aspirational brief for a new academic building. Matt Sherlock, Assistant Director,

<sup>35</sup> Martin, P. (ed) 2010 *Making space for creativity*. University of Brighton: [http://about.brighton.ac.uk/creativity/Library/UofB\\_msfc-ebook\\_FINAL.pdf](http://about.brighton.ac.uk/creativity/Library/UofB_msfc-ebook_FINAL.pdf)

<sup>36</sup> <https://en.wikipedia.org/wiki/Pinterest>

Learning Environments, University of Birmingham, told us “*Sometimes you need to plaster stakeholders with out of the box ideas in order to stimulate interest*”. Matt found that it was quite easy to get people to engage with the ideas on Pinterest because people can choose whether to simply absorb the material passively or whether to participate and rate other contributions. The use of this tool provided the Estates department with new ways of viewing requirements in order to help them brief architects.

Many people find architects’ plans hard to understand and have difficulty visualising what the space may be like in reality. This means that having readily comprehensible visual representations is important from an early stage. Advances in digital technology mean that 3D visuals are now much easier for architects to produce earlier in the project.



## VIEWPOINT

**Simon Birkett, IT and Learning Manager, University of Staffordshire**, has experience of managing learning space projects in a number of universities and views better learning space design as something of a personal quest.

In four years the University of Derby went from what Simon terms a *standing start* to £6 million investment in new classrooms, and key to this has been a partnership approach. Simon was the academic voice and worked closely with IT and Estates. At Derby any conversation about space now includes all of these three angles.

Simon’s other key message is around equipping staff and students with digital capabilities and pointing out the relevance to student employability. He is now using all of those principles at the University of Staffordshire to encourage innovation and enhance the learning and teaching experience across the institution.

Simon also told us that visiting other learning spaces is an excellent way to engage stakeholders and get them to think about what it is they really want to create. “*Only when you have been somewhere and can see how it works and feels do you really understand the space.*” For Simon this is one of the key benefits of belonging to a professional organisation that fosters this kind of networking amongst its members. “*In the early days only a few people had funding and buy in to do these kind of spaces and they seeded the experimental spaces for others*”.



## VIEWPOINT

**Bruce Rodger, Head of Infrastructure, Information Services, University of Strathclyde**, has an IT networking background and looks after all of the University’s IT infrastructure services which includes audio visual support. Over the years he has seen the different professional services come into conflict over learning spaces projects. Being able to see the issues from both sides, Bruce has identified that AV and IT people can have quite different priorities and it is only a slight exaggeration to say that each one sees the other as *the enemy*. He told us “*Often, AV people see the network people as the people with the firewalls and the rules that stop their cool gizmos working, and networking see AV as having unmanaged devices with no authentication that break their security policies*”.

Bruce has a very simple message for different professions working together for the first time on a learning space project. “*We are all on the same side here and we can work together - we just need to talk to each other*”. At Strathclyde he has taken a range of steps to break down barriers and improve communication. AV staff and those responsible for supporting student desktops are now colocated which has improved dialogue and understanding. Two of his AV staff have undertaken networking qualifications and he has also taken on a modern apprentice as part of the AV team. He found there were few recognised apprenticeship schemes for AV, unlike multimedia and IT, so they had to take an IT qualification and modify and extend it to bring in more AV expertise. Bruce says that in learning space projects “*We need to get away from the idea that AV guys just come in at the end and screw projectors to the ceiling. We need to ensure that they are brought in earlier as specialists, fully involved as professionals in the design process*”.



## VIEWPOINT

**Paul Burt, Learning Spaces Service Owner, University College London (UCL)**, started his career in learning technology and came to the realisation that certain learning spaces were not conducive to the type of pedagogy people were trying to support through the use of new technologies. He realised the need for greater shared understanding across different professional services so that the implications of a decision made by one group of stakeholders can be considered in terms of the learning experience. He says this can be something as simple as changing the specification of a blind to one that lets in more light, which can impact the legibility of projections, or the decision to put a noisy waste bin outside the room instead of a plastic one.



## VIEWPOINT

**Eleanor Magennis, Head of Space Planning, University of Glasgow**, told us that it has been very much the norm to engage students in learning space projects in all the places she has worked, but she is aware that not all universities adopt the same approach. She feels the argument that students are not really interested in long term projects, because their relationship with the institution is short term, is not a good one. Eleanor says *“Students become alumni and they like to think they have left a legacy by being involved in new buildings and projects so they are keen to participate. We don’t give them enough credit in that respect”*. She also advises that it can often make sense to use first year students who may see some of the smaller projects through to completion.



## VIEWPOINT

**James Rutherford, Learning Spaces Development Manager, University of Birmingham**, emphasises the importance of listening to the student voice but also recognises that students can be quite conservative and they will not always know what they like until they see it. He says we need to recognise that students have a variety of needs at different times: individual working, group working, or for quiet and lively spaces and we need to think about zoning to provide variety. James feels that the idea of student *misuse* of space is a misnomer as this is students showing us by their behaviour what they actually want.



## VIEWPOINT

**Toni Kelly, Associate Director, Learning Environments, University of Hong Kong**, says learning spaces are where students experience the university, and the quality of the space they are provided with for both formal and informal learning not only informs their perception of the university, but also sends them a direct message about the institution’s intentions and aspirations for their teaching and learning experience.

## Resources

There are many techniques that can be used to enable different stakeholders to have a meaningful dialogue and understand one another's perspectives. Generally the most effective techniques are those that are quite simple and visual, allowing everyone to get involved and breaking down the barriers that arise from different vocational perceptions and vocabularies.

Examples include:

- Diamond ranking activity: Newcastle University has used this technique to make clear connections between learning and teaching activities and the setting. The activity helps find out what kinds of learning and teaching staff and students value and generates discussion about the sorts of spaces that facilitate it. A practical guide is available<sup>37</sup>.
- Rich pictures (see this animation from the Open University: a rich picture about rich pictures)<sup>38</sup>.
- A good source of ideas for effective stakeholder engagement is the Jisc guide to planning a participatory workshop<sup>39</sup>.
- The Inspire Centre, University of Canberra offers a set of guidance on Designing Hybrid Learning Spaces<sup>40</sup>, including how to use the Learning Space Canvas<sup>41</sup>.
- This website from the University of Lincoln is a good example of communicating progress on a learning space project to the wider user base<sup>42</sup>.
- Guidance from the Learning Space Toolkit (produced by North Carolina State University (NCU) Libraries and its Distance Education and Learning Technology Applications (DELTA) in partnership with brightspot and AECOM) on running a workshop to creating personas in order to help you understand the needs and motivations of your target users<sup>43</sup>.
- An article comparing visual techniques used in learning space design and evaluation in UK and Australian universities<sup>44</sup>.
- An evaluation by the University of Brighton of its Creativity Centre contains much useful information both about the design of technology rich learning spaces and about creativity in higher education<sup>45</sup>.



Photo 3: Work and play is the concept behind The Mezzanine informal study area at Dublin City University.

CC-BY-NC-ND 2.0 Jiscinfonet

37 Clark et al (2013) *Making Connections: Theory and Practice of Using Visual Methods to Aid Participation in Research*. Research Centre for Learning and Teaching, Newcastle University: [www.ncl.ac.uk/cflat/news/documents/MakingConnections.pdf](http://www.ncl.ac.uk/cflat/news/documents/MakingConnections.pdf)

38 <http://systems.open.ac.uk/materials/T552/>

39 Jisc (2012) *Planning a participatory workshop*: [www.jisc.ac.uk/guides/planning-a-participatory-workshop](http://www.jisc.ac.uk/guides/planning-a-participatory-workshop)

40 [www.inspire.edu.au/ngls/](http://www.inspire.edu.au/ngls/)

41 <http://bit.ly/learningspacecanvas>

42 <http://learninglandscapes.blogs.lincoln.ac.uk/capital-programme/archived-projects/mab-third-floor/>

43 <http://learningspacetoolkit.org/needs-assessment/working-with-data/creating-personas-workshop-tool/>

44 Lee, N. and Tan, S. (2013) *Traversing the design-language divide in the design and evaluation of physical learning environments: A trial of visual methods in focus groups*. *Journal of Learning Spaces*, 2(1): <http://libjournal.uncg.edu/jls/article/view/503/383>

45 [http://about.brighton.ac.uk/creativity/Library/UofB\\_msfc-ebook\\_FINAL.pdf](http://about.brighton.ac.uk/creativity/Library/UofB_msfc-ebook_FINAL.pdf)

## 3 Managing a learning space project



### THIS SECTION AT A GLANCE

- we discuss the project life cycle that is particular to construction projects as opposed to general project management;
- we look at the range of professional advisers you may need to include in your project team;
- we point to a set of guidance and templates that you can use for all aspects of a learning space project.

### Expectations from reading this section

The intended audience for this Toolkit is a set of professionals who are already likely to have undertaken a range of projects in their working lives and who will be familiar with some form of structured project management approach. In this section we look at what is different about a learning space project.

Anyone who plays a significant role in a learning space project is likely to become involved with matters well outside their day to day professional experience and indeed their *comfort zone*. This section is intended to be read in conjunction with Section 2, Working in partnership, which points to effective means of ensuring the project team gets the input it needs to take the best possible decisions.

In particular we suggest that:

- a learning space project brings together two types of project that are in themselves complex and challenging to handle:
  - the hard aspects of a physical build; and
  - the soft aspects of a major change initiative;
- during the inevitable complications of delays, changes to specifications, escalating budget etc. it is essential to maintain a focus on the original vision for the project to ensure you end up delivering the kind of learning and teaching experience you intended.



*“Birmingham Metropolitan College had to do land deals with a range of organisations and have a road moved. City Lit was involved in a planning dispute that held them up for two years. Edinburgh’s Telford College went to a tribunal over VAT and Stephenson College’s project was held up for a year while Great Crested Newts reproduced.” (Jisc 2013<sup>46</sup>)*

<sup>46</sup> Jisc (2013) *Learning Spaces Guide*: [www.jisc.ac.uk/guides/learning-spaces/making-it-happen](http://www.jisc.ac.uk/guides/learning-spaces/making-it-happen)

### 3.1 What's new?

Many universities will already have a project management approach that they apply to all of their projects and many of the professionals for whom this Toolkit is intended are likely to have had some form of project management training and to have led or at least worked on projects in the past. In spite of this, a learning space project may be different to anything you have encountered before. The scale of such projects can vary from refurbishing a single room to a major new build and the type of approach you apply will take into account the scale and complexity of your particular circumstances. Two factors are however likely to be common to all types of learning space project:

- you are likely to apply a project life cycle model specific to building projects — we discuss project stages below;
- you are likely to be working with a range of stakeholders (particularly academics and students) who may not have experience of project type work and will need to be brought up to speed about the fundamentals of this kind of approach. It is not the purpose of this Toolkit to give an overview of general project management but in the resources section we point to some useful tools.

Some readers may have expected the section on project management and the project life cycle to have appeared at the start of the Toolkit and formed the framework for it. Our choice of order has been quite deliberate: we talk first about pedagogy because the overall aim of these projects is to support learning and we talk next about working in partnership because stakeholder engagement is the real key to establishing whether or not the project will be as successful as it might be.

In addressing the subject of project management we raise a note of caution about the model outlined below. Typically the stages of a learning space project will consist of the stages outlined in the RIBA plan of work<sup>47</sup> which applies to any large scale project. It is important that sufficient time is given to the first key stage: strategic definition, stage 0, to ensure it is properly defined. Frequently we are trying to do something that has not been done before and the use cases for most other types of build are far better established than some of the experimental learning spaces we are developing. Frameworks and models can help but only to the extent that they do not constrain thinking about what is unique about each particular project. There is no one expert we can turn to for answers hence the emphasis this Toolkit places upon stakeholder engagement.



*“Every building project is a one-off.”*  
Eleanor Magennis

Normally for learning spaces projects the Estates department of the university will appoint a project manager from their team. If the project is large and complex there may be an external Project Manager as well as part of the external design team. Ensuring good communication channels are established and maintained from the outset is important to ensure the key stakeholders are kept informed and consulted.

### 3.2 Project stages

Typically the stages of a learning space project will consist of the stages outlined in the RIBA plan of work:

- 0 strategic definition (previously known as appraisal and feasibility)
- 1 preparation and brief
- 2 concept design
- 3 developed design
- 4 technical design
- 5 construction
- 6 handover and close out
- 7 in use



*“Sometimes you need to slow down to speed up. Taking more time at the outset in forming the design brief and focusing on what the activities are can lead to a much better set of outcomes.”*  
James Rutherford

The length and complexity of each of these stages will depend on the scale of the project.

<sup>47</sup> RIBA Plan of Work (2013): [www.ribaplanofwork.com/](http://www.ribaplanofwork.com/)

## Definition phase (stages zero and one)

Some projects, such as refurbishing a single classroom, may operate within constraints that make the project definition relatively straightforward. In other cases there may be a period of options appraisal in order to determine whether new build or refurbishment is the most appropriate solution. We point to some tools for doing options appraisal in the Resources section.

A number of contributors to this Toolkit have suggested that when making investment decisions around refurbishment, it may not always pay to tackle the worst space first. The point was made that upgrading ten rooms with minor problems might be cheaper and more worthwhile than the investment required to adapt a space with significant design issues.

In some cases the distinction between new build and refurbishment may be less clear cut. Paul Burt, Learning Spaces Service Owner, University College London (UCL) told us *“Refurbishments at UCL might as well be a new build. Many of the spaces are taken back to a pillar and some concrete slabs”*.



*“Value engineering is seen by many as the process through which the interesting and innovative elements of a project are slashed in order to save money. We need to be clear that any cuts made for good financial considerations do not impact upon the staff and students’ ability to use and enjoy the space effectively.”* Toni Kelly

## Design phase (stages two to four)

This is the phase where you will really start to realise the vision for a particular type of learning environment and the phase where you should have the widest range of stakeholders involved. We cover more about your stakeholders and how to work with them in Section 2, Working in partnership. Visual representation is important at this stage. Many people find it difficult to understand plans and hard to imagine in 3D what a building will look like. It is difficult for people to buy in to something they cannot fully understand, so obtain representation quickly so that people know what you are talking about.

Taking time to meet in the space and look at the requirements and the design issues, barriers and opportunities is much more valuable than trying to make design decisions around a table on a paper plan.

This Toolkit emphasises the importance of creativity and innovation in learning space design and we talk about this in Section 1, Building a new pedagogy and Section 2, Working in partnership.

It is equally designed for busy practitioners in order to help them create usable and effective spaces and we emphasise importance of applying recognised standards to the design. There are sections to support you with this, specifically looking at functional room design standards, audio design standards, visual design standards and IT standards.

It pays to have a series of reality checks on your design ideas. Your architect and specialist advisers will help you with this but it always pays to involve people with local knowledge as well. See the Reality checks later in this section.

## Construction phase (stages five and six)

The more quickly you can complete this phase the easier it is to manage costs and changes to plan. This phase is likely to involve a potentially large number of external contractors so you need a well defined management control system with only one person responsible for giving decisions and information to contractors. Effective change control mechanisms are vital at this stage. Although this phase is likely to involve Estates staff and other professionals rather than general users of the space, it is important to maintain effective communication especially where unforeseen problems result in changes to the original design. Appropriate involvement of key users of the space at this stage can also help to minimise *snagging*. Snagging traditionally means identifying defects that need fixing at the end of a building project but early identification of issues can often make them easier to solve.



Photo 4: Construction work at the Saltire Centre, Glasgow Caledonian University.

## The occupancy phase (stage seven)

The day the first users move into the space is an important milestone to be celebrated but it is unlikely to mark the end of the project. There is a need for effective post occupancy evaluation to ensure that the space is functioning as intended and we address this topic in Section 6, Evaluation.

It pays to think about how occupancy might change as a result of new developments. Many learning space projects have been *victims of their own success* and seen occupancy levels far in excess of their original expectations. This can have important implications for planned maintenance and cleaning regimes. In some cases major changes have been necessary to cope with the increased footfall as in this example from a post-occupancy evaluation report at the University of Wolverhampton: *“From the onset of occupation, it became evident that the lifts could not cope with the volume of traffic ... a similar specification to other lifts within the university had been used but, due to the massive usage, this was not sufficient. As a result, higher specification machinery was retrospectively fitted”*<sup>48</sup>.

### 3.3 Working with professional advisers

In a significant learning space project, particularly one that involves new build, you are likely to find yourself working with a range of professional advisers. For those who have not worked on this type of project before the range of specialists can seem quite bewildering but obtaining the right expert advice at the right time can help save you costly mistakes.

Philip Badman has led a number of new builds in the further education sector: as Vice-Principal at City Lit he found himself working with 158 individuals from 37 firms to complete a single project<sup>50</sup> that ran into planning difficulties in a densely built urban setting. This included 47 lawyers from four different firms, all specialising in different aspects of the law, and specialists such as a party wall surveyor, a rights of light surveyor and archaeologists. As a result of this experience Phil formed clear views on what makes a good adviser.

A good adviser (according to Phil) is one who always:

- thinks of the problems ahead for the client;
- identifies, analyses, explains the options;
- alerts the client to risks, and mitigation;
- confirms scope of services and what is out of scope;
- avoids saying *“but you didn’t ask that question”*;
- adheres to a strict reporting/instruction regime;
- translates for the academics;
- sets a realistic project process and timeline;
- is patient!



*“Architects tend to lose interest in the spaces as soon as the ribbon is cut, whereas operations and building services teams need to focus on how the space will continue to operate five years down the line.”* Bruce Rodger



*“When faced with counter ideas from a group of resource constrained, experienced building professionals, it is easy to see why aspects of the vision might be dropped in favour of simpler or more traditional solutions. In the confines of meetings, especially given time pressures, such decisions can be made quickly and easily, but they are difficult to undo later.”* (Martin 2010<sup>49</sup>)



*“On virtually every project IT and AV are last on-site. If anything else has gone wrong earlier in the project then their costs are squeezed. They are also often seen as being the cause of the hold up even though they are taking the time they said they would take.”* Bruce Rodger

<sup>48</sup> University of Wolverhampton (2005) RIBA Post Occupancy Report: The Millennium City Building: [www.architecture.com/Files/RIBAHoldings/PolicyandInternationalRelations/ClientForums/Higher/PostOccupancyreviewofbuildings/TheMillenniumcitybuilding.pdf](http://www.architecture.com/Files/RIBAHoldings/PolicyandInternationalRelations/ClientForums/Higher/PostOccupancyreviewofbuildings/TheMillenniumcitybuilding.pdf)

<sup>49</sup> Martin, P. (ed) 2010) Making space for creativity. University of Brighton: [http://about.brighton.ac.uk/creativity/Library/UofB\\_msfc-ebook\\_FINAL.pdf](http://about.brighton.ac.uk/creativity/Library/UofB_msfc-ebook_FINAL.pdf)

<sup>50</sup> Further background on the City Lit project [http://fanshawe.hciyork.co.uk/metadot/index.pl?id=2573&isa=DBRow&field\\_name=download&op=download\\_file](http://fanshawe.hciyork.co.uk/metadot/index.pl?id=2573&isa=DBRow&field_name=download&op=download_file)

It is vitally important that you choose the right architect and interior designers that fully understand your vision for the project and that you work together as an integrated team from the outset. There is no magic formula for this and in this type of project your general feel for what a company would be like to work with can be an important indicator from the outset as to whether or not the relationship will work. Choose your partners as carefully as you would choose your own staff and, from then on, the advice is really the same as for effective working in any project team: be clear about expectations, roles and responsibilities and decision making authority and establish effective communication channels that work for you.

The following list of professional advisers and their roles in a learning space project is adapted from the Jisc (2013) guide<sup>51</sup> on this topic.

## Architect

The project architect is the key to interpreting your vision, developing the ideas that you have, and transforming it into reality. Architects have the skills to coordinate and manage, in conjunction with your internal decision making mechanisms, the overall building project and to act as your adviser ensuring that others, such as the builder, understand and work to meet your hopes and aspirations. If you do not want the architect to take this lead coordinating role then you may need to engage a professional project management company to do so.



*“The role of the architect is to turn your vision into a reality. What they can’t do is create the vision.” (Jisc 2013<sup>52</sup>)*

More and more university Estates departments are moving towards frameworks for their architects or design teams which are renewed on a three to five year basis. This is to ensure best value for money and save time on procuring design teams on individual projects. For large, complex projects, a separate procurement process may be followed or a design competition may be used.

## Interior designer

An interior designer, as the name implies, will be concerned with the interior of a learning space although in some cases the remit may extend to the external facade of buildings as well. Interior design is about much more than decoration as it has an emphasis on functional design and effective use, and can require an understanding of technical issues such as heating, ventilation and air conditioning (HVAC), as well as acoustics and lighting. In the example of a learning space renovation project, an interior designer may design the layout of the space working with an architect who would deal with any changes to load bearing walls etc. Architectural firms often employ or partner with particular interior designers.

## Mechanical and electrical engineer

One of the most difficult aspects of any build or refurbishment is the provision of mechanical and electrical systems and services including IT. Making sure you contract with a high quality mechanical and electrical engineering organisation is a crucial success factor for the implementation of technology rich spaces. With this type of space it is also advisable to make separate provision for IT systems and services by hiring in specific expertise. You do not want to risk ending up with a beautiful building in which the IT and electrical and mechanical systems let you down or cannot be easily adapted to future needs. Be wary of any companies who view IT and AV (including access control and CCTV) as simply a subset of the electrical work and who do not appear to fully understand your requirements.

## Project manager

Sound project management is essential to ensuring that the project is delivered on time and within budget. You should weigh up the benefits of hiring a project management company to take on this responsibility against the benefits of local knowledge (if you have the skills to take this on inhouse). Your Estates department will be best placed to advise on whether the relevant skills exist within the university.

<sup>51</sup> Jisc (2013) *Learning Spaces Guide*: [www.jisc.ac.uk/guides/learning-spaces/professional-advisers](http://www.jisc.ac.uk/guides/learning-spaces/professional-advisers)

<sup>52</sup> Jisc (2013) *Learning Spaces Guide*: [www.jisc.ac.uk/guides/learning-spaces/the-architects-role](http://www.jisc.ac.uk/guides/learning-spaces/the-architects-role)

## Quantity surveyor

During the design of the building and its procurement, you need to know whether your cost expectations for the planned features and facilities are realistic. For this you need the professional help of a quantity surveyor. The surveyor should be able to predict whether what you are expecting to receive for your money can be achieved and help you to evaluate tenders for each phase of the work to make sure that you are comparing like with like when selecting providers. The procurement team within a university will also be involved with contract tenders and, as for the design team, there may be frameworks for contractors. The surveyor may even be able to suggest ways in which you can save money.

## Acoustician

An important aspect of learning space is how sound is controlled and managed. You should consider employing an acoustician to help model the sound within the space you are planning and to advise on floor, ceiling and wall finishes that can deliver a suitable soundscape for the space.

## Lighting consultant

Lighting in learning spaces is a crucial factor. You should obtain the advice of a lighting consultant in order to ensure that the space has the flexibility to provide good lighting throughout a daily, weekly and annual cycle.

## Artists

Artwork can help to provide a stimulating environment and is increasingly being used in learning spaces to add an inspirational element to the space. You should consider using one of the specialist agencies that can introduce you to a range of artists and help you select and procure artwork appropriate for the space.

## Health and safety related consultants

Projects of this nature are likely to require specialist support to ensure that appropriate health and safety related specifications are met. These might include a fire consultant and a CDM (Construction Design and Management) coordinator who will focus the attention of the whole team on the health and safety aspects of the project to facilitate early identification of potential hazards.

## Intelligent client

This is already a long list and there may be other specialist needs particular to your type of project. A concern in dealing with so many professionals is not only how to ensure client needs are understood but also how to ensure what is intended is implemented (or when things are not progressing as intended what questions need to be asked). You can employ professional help to act on your behalf as an interface between all, or any, of the professionals that you need to work with and with the builders. The trick here is to get the help you need without creating an extra layer that can add to bureaucracy and misunderstanding. Managed well, such an *intelligent client* will act intelligently on your behalf bringing in professional knowledge that you do not possess.

## Resources

- The RIBA Toolbox contains a tool to help you specify and define project roles<sup>53</sup>.

## 3.4 Reality checks

It pays to have a regular series of reality checks on your design ideas. Your Estates contact, architect and specialist advisers will help you with this but it always pays to involve people with local knowledge as well. This series of checklists for different aspects of the build has been adapted from Jisc guidance on Learning Spaces (2007<sup>54</sup>) and (2013<sup>55</sup>).

<sup>53</sup> RIBA project roles: [www.ribaplanofwork.com/Toolbox.aspx](http://www.ribaplanofwork.com/Toolbox.aspx)

<sup>54</sup> Reality checks from the Jisc Learning Spaces Guide (originally published in 2007): [www.webarchive.org.uk/wayback/archive/20130503220624/http://www.jiscinfonet.ac.uk/infokits/learning-spaces/design/reality-check/](http://www.webarchive.org.uk/wayback/archive/20130503220624/http://www.jiscinfonet.ac.uk/infokits/learning-spaces/design/reality-check/)

<sup>55</sup> Jisc Learning Spaces Guide (updated in 2013): [www.jisc.ac.uk/guides/learning-spaces/reality-check](http://www.jisc.ac.uk/guides/learning-spaces/reality-check)

## General design checklist

- Does the overall design fit its surroundings and comply with any stipulations in outline planning consent?
- Does the design take full account of the layout of the site and any issues such as seasonal flooding or erosion?
- Are initial surveys still valid in the light of the final design? (For example John Wheatley College, Glasgow had to undertake further geotechnical surveys once the building footprint was known.)
- Does the layout of the site take account of all access considerations including pedestrian, bicycle, public transport, parking?
- Does the design take account of cleaning, maintenance and waste disposal considerations e.g. is it possible to clean the windows without blocking access routes?
- Have you considered the functions going on in each part of the building relative to one another in relation to considerations of noise, health and safety hazards, and special security requirements?
- Have you considered the functions going on in each part of the building relative to one another in relation to sight lines and issues of privacy and security?
- Have you considered the design in relation to your business continuity and/or disaster recovery plan to identify issues and/or opportunities?
- Have you thought enough about future changes? There may be a need to review your plans particularly where planning or other issues have caused a delay to the project e.g. a college planning to build a photographic darkroom found that the digital revolution overtook them whilst they were involved in a planning dispute.

## Technical infrastructure checklist

This is an area where you would not necessarily expect architects and builders to have a lot of specialist knowledge, so you will need to ensure that you involve suitably qualified professionals in your reality check. You might start by asking:

- Have you considered the location and capacity of power sources?
- Do you know the location and precise route of other mains services?
- Do you know where your nearest Janet network connection is situated?
- Have you looked at the length of cable runs?
- Have you considered the location of server rooms e.g. to ensure you have not sited one beneath a water tank?
- Have you considered the ventilation/cooling requirements of server rooms and any other rooms with specialist machinery?
- Do you know the details of rack sizes etc. to ensure that the equipment will fit into the planned space?
- Has there been adequate liaison between technical and IT suppliers and your own technical or IT staff to ensure that new equipment is compatible with existing services/infrastructure?
- Have you checked sight lines in relation to all static audio visual equipment in teaching rooms?

- Can you get a mobile phone signal where necessary such as in reception, and in social and collaborative areas?
- Will printing/copying or other equipment cause noise in open plan areas?
- Have you fully considered all accessibility issues e.g. does the estimated footprint allow for larger screens/keyboards/wheelchair access where necessary?
- Have you thought about all the spaces people might use as learning spaces - are garden areas and study bedrooms wifi enabled?
- Is it clear what source is funding the cost of new and replacement equipment (the project, institutional or local budget)?
- Have you taken all possible steps to facilitate flexibility such as using raised floors so that services can be moved as necessary?
- Are you confident you understand the ongoing costs associated with the technology?
- Have you thought about replacement cycles and the scheduling of upgrades/replacement?

## Checklist for individual spaces

The devil, in any project, is usually in the detail. Sometimes architecturally stunning buildings can suffer from a lack of understanding about how the space is actually to be used. Having said that, a stimulating space will itself generate ideas about new ways of learning and working so we need to be wary of focusing too heavily on the way we do things now. The following prompts may alert you to some potential problems without stifling your desire to be creative and innovate. You may also want to think about using space sheets<sup>56</sup> to ensure you have captured all requirements fully and in a way that can be accurately costed:

- Have you considered the location of any specialist, heavy, bulky equipment and ensured that it can be installed at the appropriate time?
- Are the lifts large enough to permit the movement of bulky items in future?
- Have you considered seasonal variations in relation to the processes carried out in the space? Will the space be used for occasional high volume activities such as enrolment or examinations and what are the implications of this?
- Will a space ideal for summer usage have suitable places to hang heavy coats and store wet umbrellas?
- Is there adequate secure storage for staff and student personal belongings?
- Have you looked at open access areas in relation to data protection considerations? This may be a particular issue where staff and students are using the same space.
- Have you looked at flexible spaces in relation to health and safety considerations particularly where users may rearrange furniture? You need to think about the risks involved in physically moving furniture (including the possibility that new configurations could block access to exits or essential services) and the risks of trailing power cables.
- Atrium areas, mezzanine floors and open walkways all help create a sense of height and space – have you looked at these spaces in relation to health and safety considerations particularly in relation to objects falling from one level to another? You could perhaps ensure that rails on balconies are shaped to prevent people placing objects on the edge.

<sup>56</sup> An example of a completed space data sheet, created by Edinburgh College: <http://bit.ly/sps-example>

- New spaces frequently attract usage levels in excess of those anticipated – can cleaning and related services cope with peaks in usage?
- Can cafeteria areas cope with peaks in usage without queuing and congestion?
- Have you considered circulation around the space at peak times, such as when large numbers of students are moving from one class to another, to identify potential bottlenecks?
- Have you considered the relationship of fixed seating to heating and ventilation outlets to ensure users are not seated in draughts or too close to heat sources?
- Assuming a no smoking policy in the building, where will smokers congregate and will this result in issues relating to access and litter?
- How will you manage noise levels where open access and flexible areas are sited in close proximity to areas where formal teaching is going on?
- Have you thought about signage (particularly in large, open plan spaces or zoned spaces) to help users use the space and locate services effectively?
- Have you thought about the costs and potential difficulty of changing signs as the building use develops?
- Where staffed help points are available in student areas will the staff have access to all of the equipment they need to deal with queries effectively?
- Have you thought about how you can ensure that staffing levels can respond to demand?
- What are the maintenance needs in each space? Avoid situations where routine maintenance becomes complex (for example where it takes a cherry picker or scaffolding to change a light bulb and in the meantime a whole study area remains dim or gloomy).
- Will there be 24x7 use?
- Have you considered security for people and equipment outside normal operating hours?
- Space for meeting privately – you may wish to consider having some private areas that do not require reservation through a booking system, in order to respond to *ad hoc* occasions such as responding to a distressed student.
- Finally have you thought enough about future changes or have you concentrated too much on how things are at present?



## VIEWPOINT

**Caroline Pepper, Learning and Teaching Space Manager, Loughborough University**, has worked on learning space projects in facilities management and corporate services departments so has seen the issues from a range of different stakeholder perspectives and this has influenced her approach to project management.

The sheer number of different stakeholders involved can make these projects very difficult to manage. Meetings can be difficult to organise and to handle as there are many different perspectives to be considered. A structured methodology is needed in these circumstances but Caroline warns that too much emphasis on following a standard model to the letter can inhibit you recognising what is unique about your particular project. In particular, once a stage has been signed off, change can be difficult and bureaucratic to manage even though some degree of change is inevitable in long and complex projects.

This highlights the value of bringing all stakeholders to the table as early as possible. Loughborough ran a number of informal workshops to understand and influence the design of a new campus in London. The stakeholders involved included representation from all of the schools, professional services, service departments and most importantly students, to gain input to the initial ideas from all perspectives.



## VIEWPOINT

**Tessa Rogowski, Client Services Manager, University of Essex**, emphasised the need for clarity around the decision making process in projects. Tessa made the point that as you go through the RIBA stages, the questions that you ask, and hence the options that you have available, narrow down. As she put it *“You start out at stage zero thinking pigs might fly and by stage five you realise it isn’t going to happen because you can’t nail wings to pigs”*. What this means in project management terms is that people need to know exactly what lines of authority and decision making exist (bearing in mind that this is different in every project). They need to know how to ask for changes to the brief and when it is reasonable to expect that adjustments can still be made. Tessa feels that *“Having this very clear at the start of a project makes the difference between a successful and an unsuccessful one”*.



## VIEWPOINT

**Sally Jorjani, Head of Academic and Business Liaison, Edinburgh Napier University**, has a background in project management. Sally feels it does not matter what project methodology project teams choose to follow so long as they do use a structured methodology and it is one that gives them a holistic view. Sally does however have some concerns that the RIBA life cycle and terminology may not be very meaningful to all stakeholders and that too much emphasis on the building structure may cause project teams to miss other relevant perspectives. Sally is at pains to point out the range of stakeholder engagement and change management skills that are needed to make these types of projects successful.

Sally also emphasises that project timescales may be very different to what you are used to in other projects and the sheer length of projects can make it difficult to keep stakeholders interested and engaged. An important tip from Sally when managing projects such as this is to realise how long it may take and think about *chunking things down*. Don’t think in terms of a three year project but rather break it down into phases. She told us *“Bringing people along with you takes time and a lot of consultation. You might even need to review and rework policies to make some of the desired changes”*. Sally also advocates having somebody from your finance department on the project team, even for relatively small projects, so you can be confident that your budgeting is robust and there will be no surprises.



## VIEWPOINT

**Toni Kelly, Associate Director, Learning Environments, University of Hong Kong**, feels it is absolutely key that you have a good working relationship with the project manager. Some project managers take the view that it is their job to deliver the brief and hand it back to you when it is finished, whereas others will hold your hand, lay down the ground rules and point out any room for manoeuvre. Toni says *“The most successful and enjoyable projects I have been involved with have featured a combination of fierce time and cost control combined with an ability to listen and act accordingly to my concerns or requests for change (not always agreed!) during the life of the project”*. She finds that as soon as you get on site you see things that will impact the user experience so you must understand where you can make constructive suggestions and where changes are possible. Toni pointed out that people in a higher education context don’t work with construction professionals very often so they can easily get into a situation where they don’t know whether they should raise an issue or not. Toni told us *“Over time I’ve just got a bit braver”*. Toni also emphasises the importance of managing and tracking changes: *“If you think you have agreed something and then the changes aren’t tracked it can be too late to do anything about it”*.

## Resources

- Imperial College London owns one of the largest estates in the UK higher education sector and undertakes a wide range of refurbishment, redevelopment and new build projects. The College has developed its own project procedures based on best practice from industry, applying PRINCE2® methodology and following RIBA project management stages. The College has produced an excellent website with guidance and templates covering all aspects of building projects<sup>57</sup>. In particular you might wish to look at the Imperial College process map which gives an idea of the complexity of a building project and the tasks and deliverables at each of the stages<sup>58</sup>.
- Many of your stakeholders may be unfamiliar with formalised project management approaches and you might find it useful to give them some kind of overview of why such approaches are needed, what purpose particular tasks and outputs serve and an explanation of any project management jargon you may be using within the project team. A resource specifically adapted for the needs of the sector and well used for many years is the Jisc guide to project management<sup>59</sup>.
- HM Treasury Green Book is the standard text on appraisal and evaluation in central government and provides useful guidance for other public sector type organisations<sup>60</sup>.
- Department for Education and Skills (now the Department for Education) guidance on options appraisal is aimed at schools but contains some useful pointers<sup>61</sup>.
- The Learning and Skills Council (disbanded in 2010) produced some Guidance on College Property Strategies that is aimed at the further education sector but nonetheless contains some useful information for universities<sup>62</sup>.
- There is also a publication by the UK Higher Education Space Management Group (SMG) looking at how space needs modelling is approached in further education (and internationally in higher education)<sup>63</sup>.

57 [www3.imperial.ac.uk/estatesprojects/projectprocedures](http://www3.imperial.ac.uk/estatesprojects/projectprocedures)

58 <https://workspace.imperial.ac.uk/capitalprojects/Public/processmap/ProcessmapA3.pdf>

59 Jisc (2008) *Project management - A project management methodology based on PRINCE2*: [www.jisc.ac.uk/guides/project-management](http://www.jisc.ac.uk/guides/project-management)

60 HM Treasury (2013) *The Green Book: Evaluation and appraisal in central government: HM Treasury guidance for public sector bodies on how to appraise proposals before committing funds to a policy, programme or project*: [www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government](http://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government)

61 Department for Education (2002) *Finding the right solution. A guide to option appraisal*: [tools.jiscinfonet.ac.uk/downloads/lsd/dfes-options.doc](http://tools.jiscinfonet.ac.uk/downloads/lsd/dfes-options.doc)

62 Learning and Skills Council (2002) *Guidance on College Property Strategies*: [http://dera.ioe.ac.uk/13355/2/Supplement\\_A\\_to\\_Circular\\_02-20\\_Guidance\\_on\\_college\\_property\\_strategies.pdf](http://dera.ioe.ac.uk/13355/2/Supplement_A_to_Circular_02-20_Guidance_on_college_property_strategies.pdf)

63 Space Management Group (2006) *UK Higher Education Space Management Project Managing space: a review of English further education and HE overseas*: [www.smg.ac.uk/documents/FEandoverseas.pdf](http://www.smg.ac.uk/documents/FEandoverseas.pdf)

## 4 Effective learning by design



### THIS SECTION AT A GLANCE

- we look at recognised standards for a range of aspects of learning space design: general good design practice; functional room specifications; audio/visual standards; IT standards;
- we discuss lessons learned from previous learning space projects which form the basis for the guidance given here.

### Expectations from reading this section

Each of the professional associations contributing to this Toolkit has a specialist interest in one or more of these subsections. We have however grouped them together to encourage readers to take an overview of the topic as a whole because of the interrelationship between the various aspects and the way in which they provide opportunities and constraints affecting the way each of the professions can support users of the space.

One of the main lessons learned from evaluation of other spaces is that some of the management and usability issues that occur can be designed out if a holistic view is taken at an early stage. Conversely, any project is likely to go through a stage of conceptualising an ideal design and then some form of *value engineering* to better match the specification to the resources available for the project. The guidance in this section will enable you to take a value engineering approach whilst having an eye on the long term sustainability and usability of the space.

In particular we suggest that:

- Heating, ventilation, cooling and noise are key to user comfort and perceptions of the space and economies in this area can lead to serious usability issues that are costly and difficult to rectify afterwards. Natural light is important for the wellbeing of staff and students, and staff in particular exhibit a preference for having some form of environmental controls that can be user regulated.
- The ability to both see and hear what is going on in any kind of formal directed learning session is fundamentally important for learners. The availability and affordability of technology to support visual display may make issues of poor sight lines an easier problem to solve than poor acoustics in cases where electronic display is used, although this is not the case where writing remains important to the teaching practice.
- As learning and teaching practice develops we should not necessarily be constrained by the assumption that all spaces used for teaching should have a defined front and we need to understand the implications of new types of collaborative learning for those supplying audio visual and other teaching facilities.

## 4.1 Introduction to design standards

The guidance in this section is based on three fundamental premises<sup>64</sup>:

- learning spaces must be usable by all those who need to work in the space;
- users of the space must be able to hear what is presented;
- learners must be able to see what is presented.

The use of the term *design standards* may give rise to a concern that all learning spaces that apply the same standards will end up looking alike; this could not be further from the truth. The requirements of a learning space amount to far more than usability, viewability and audibility. The application of different styles of pedagogy and the technologies that support this are what ultimately lead to differentiated, engaging, and inspiring learning spaces. This is why the design principles discussed in Section 1, Building a new pedagogy, are so important and why inspiring and motivating students is a core aim. We need to delight as well as be functional.

Good design in learning spaces will take account of the following characteristics of the space<sup>65</sup>:

- **Intended use** — thought needs to be given to the learning and teaching scenarios to be deployed and the identities of the learners and teachers.
- **Adaptability** — so that the space can be easily and quickly reconfigured for the range of different teaching and learning scenarios for which it is intended.
- **Inclusivity** — the space should be designed so that it is readily accessible and usable by all members of the student and staff population. Bearing in mind that significant numbers of people have physical disabilities, mental health issues and learning difficulties such as dyslexia, choice and control over the learning environment can make a significant difference to the usability of space<sup>66</sup>.
- **Usability** — spaces that are easy to use will be used. User interfaces should be simple and intuitive. When designing controls, make sure that the most used items are the most visible and that controls that are likely to confuse less expert users are difficult to find accidentally. Related characteristics are **consistency** (e.g. of interfaces, software versions, layout, colour of cables, placing of user controls) and **reliability** (e.g. avoid equipment that uses batteries, can be inadvertently removed or has a high failure rate). Inevitable tensions between the degree of standardisation implied by these characteristics and a desire to innovate and experiment will have to be worked through with stakeholders.

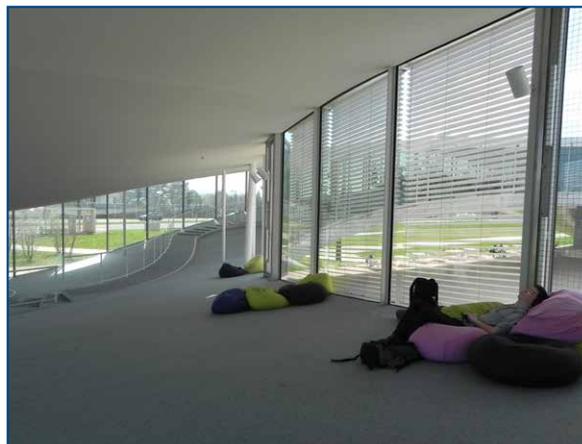


Photo 5: The Rolex Learning Center, EPFL, Lausanne, was conceived as a rolling landscape with formal and informal study areas.

CC-BY-SA-2.0 Aspire-edu



*“It should be obvious on entering the space how to turn equipment on and get it running without having to read a manual. The very exercise of trying to achieve this scenario should focus the minds of the designers onto the important issue of how the space and its technology are to be used to promote learning instead of creating ‘eye candy’. This process would need the engagement of potential user groups at the design stage to go through scenarios of operation, but would hopefully result in a much more user friendly environment.” (Martin 2010<sup>67</sup>)*

<sup>64</sup> These premises presuppose that any users of the space who have special needs will be supported through appropriate facilities and assistive technologies to make full use of the space and participate fully in learning activities

<sup>65</sup> A report on evaluation models and practice in technology supported learning spaces (Pearshouse et al 2009) gives a similar list of aspects of learning space design that appeared to contribute most to effective learning in the evaluations they reviewed. Pearshouse et al (2009) *A Study of Effective Evaluation Models and Practices for Technology Supported Physical Learning Spaces*. Report produced for Jisc: <http://oro.open.ac.uk/29996/2/>

<sup>66</sup> Visitors to the Rolex Centre, the iconic learning resource centre at the École Polytechnique Fédérale de Lausanne in Switzerland, are often puzzled by a series of what appear to be rubber tramlines crossing otherwise minimalist open spaces. The space was conceived by its architects as a rolling landscape for learners to explore. This idea of self direction in the space was reinforced by minimal signage. In practice the space proved extremely difficult for visually impaired users to navigate and the tramlines are necessary to help such users get from one part of the building to another: <http://rolexlearningcenter.epfl.ch/>

<sup>67</sup> Martin, P. (ed) 2010) *Making space for creativity*. University of Brighton: [http://about.brighton.ac.uk/creativity/Library/UofB\\_msfc-ebook\\_FINAL.pdf](http://about.brighton.ac.uk/creativity/Library/UofB_msfc-ebook_FINAL.pdf)

- **Comfort** — heating, ventilation and cooling are common sources of complaint from building users and require careful consideration. The availability of natural light can also do much to promote learning. In the past comfort has not been a high priority when selecting furniture for student use but the provision of high quality, comfortable furniture is an important element in ensuring student time on task<sup>68</sup> in a particular learning space.
- **Proximity** — users must find the space convenient to access: the best space in the university may not be used as much as the nearest one. Speculative developments may be better sited in less used spaces and, where possible, close to a support team. Current trends in integrating learning and social space bring their own set of issues, not least the transmission of noise and odours from hot food from social spaces into more formal study areas, so zoning and differentiation needs to be carefully thought through.
- **Sustainability** — this relates to environmental sustainability, ongoing maintenance and the need for equipment and software upgrades. The need to conduct training and repeat this for new staff or new cohorts of students is also something that can be overlooked in terms of ongoing costs.
- **Durability** — think carefully about the expected lifespan of floor coverings, furnishings and fittings. A lesson learned from many new developments is that increases in user footfall in the new spaces can greatly exceed your wildest expectations. When considering the funding needed for a build or renovation project you need to take into account routine replacement of equipment and upgrading/maintenance of decoration.



*“The problem that is most easily solved is making things usable and this is where the technologists fail. You need to get user interfaces right because if people can’t use it you will spend all your time supporting it.” Tessa Rogowski*



*“Spaces should work seamlessly whether the teacher wants to use technology or not, the technology should not overpower the room or force users to think it must be used.” Toni Kelly*

## 4.2 Designed to last?

The term “*Long life, loose fit, low energy*”<sup>69</sup>, coined by RIBA president Sir Alex Gordon in 1972, sums up good design that recognises buildings need to have a degree of permanence and also be capable of adaptation to a variety of uses over their lives.

When designing a building it is often useful to think of it in terms of a series of components or layers with different lifespans. The diagram below is taken from the work of Brand (1994)<sup>70</sup> and shows the layering including the geographical site which is permanent, the load bearing structure which is expensive to change, an external skin that may change due to fashion or the need for maintenance and internal services and structures which have a much shorter lifespan. The concept was used in the building of a number of further education colleges that have movable internal walls so that space can be reconfigured as numbers in different subject areas vary.



Photo 6: Node chairs are used for easy reconfiguration of groups at City University.

© City University

68 Chickering, A. W. and Gamson, Z. F. (1987) *Seven Principles for Good Practice in Undergraduate Education*. American Association for Higher Education: [www.lonestar.edu/multimedia/SevenPrinciples.pdf](http://www.lonestar.edu/multimedia/SevenPrinciples.pdf)

69 See discussion of the model by Langston (2014) *Measuring Good Architecture: Long life, loose fit, low energy*: <http://ojs.ecsdev.org/index.php/ejsd/article/viewFile/186/178>

70 Brand, S. (1994) *How Buildings Learn: What Happens After They're Built*. Viking Press.

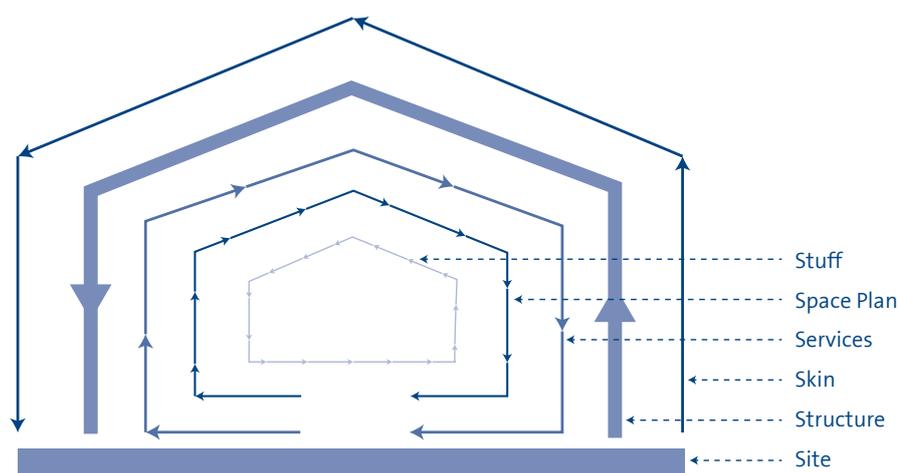


Figure 4: Brand's Six S's from *How Buildings Learn*

The flexibility of the building is therefore underpinned by those building elements at the lower end of the list in this diagram. The more that the elements further up the list can be kept separate from the physical envelope and servicing strategy of the overall building, the more opportunity they have to change. For example ventilation systems which depend upon the specific arrangement of internal walls (or lack of them) can sabotage the possibility of organisational change.

In designing learning spaces it pays to be realistic about how long you expect each element of the space to last. Most institutions try to design with low maintenance in mind but, even so, it is not unusual to see relatively new learning spaces showing signs of wear and tear. Floor boxes (for electrical power) with their covers snapped off, coffee stains on furnishings and floor coverings, broken writing tablets and difficult to reach architectural features that gather litter and dust are common problems. Contributors to this Toolkit have given quite different indications of how long their institution would expect a new development to last from a *shopping mall* model where internal fittings can be changed quickly and cheaply, to an expectation of no significant change for around 10 years. Whichever end of the spectrum you plan for, you need to consider whether all of the components are sufficiently durable to last this length of time.



#### VIEWPOINT

**Matt Sherlock Assistant Director, Learning Environments, University of Birmingham** has two key messages for colleagues developing learning spaces. The first is that everything in a learning space needs to be *appropriate*. It may be either innovative or low tech but it needs to be appropriate for the learning activities taking place.

The second is that universities need to think in terms of managing a *portfolio* of spaces. Not every space can be generic and the flexibility to better support a range of learning activities is best achieved through shared ownership of the institution's resources rather than thinking about designing individual spaces for maximum flexibility.

Matt is trying to achieve this by changing the vocabulary people use when booking space. He tells us that in the past people have tended to be very vague about their space requirements. They might say they want a flat floor and space for 50 students but this doesn't tell you what is actually going on in the space. Matt realises we need to ask less about the functional requirements (given that most suites have quite similar facilities) and more about the desired learning approach. This will allow the matching of activities to space in a much more intelligent way. This links back to the idea that the space needs to be appropriate. What is actually needed might be a relatively small room suitable for formal teaching with informal spaces located nearby for breakout activity. Matt notes that the person teaching often is not the person who is doing the room booking and a lot can be lost in translation but overall there is a very positive message here about collaboration and the potential for much better space utilisation if the right class is timetabled in the right room.



## VIEWPOINT

**Caroline Pepper, Learning and Teaching Space Manager, Loughborough University**, told us that one of the main surprises from Loughborough's extensive consultation with students about learning spaces was quite simply the diversity of student views. This has led Loughborough to define its learning space strategy as being about *diversity in design*. Many students still want tiered lecture theatres whilst others are demanding more collaborative space. Caroline told us that node chairs<sup>71</sup> are one of the best examples of an innovation that has polarised views. *"They are a bit like Marmite: students and staff either love them or hate them"*. The chairs are available in a range of colours which makes it easy to form groups by saying, for example, students in orange chairs get together and form a group, but some students don't cope well with this type of activity. Caroline also feels that the chairs work well in small groups but once you get to over 30 the room starts to look messy and uncontrolled and some students do not like this. Cultural factors come into play here and, in particular, some groups of international students exhibit a strong preference for being taught in tiered lecture theatres because this most closely mirrors their previous educational experience.



## VIEWPOINT

**Tessa Rogowski, Client Services Manager, University of Essex**, strongly promotes the principles outlined in this Toolkit of ensuring (with appropriate adjustments for particular user needs when necessary) audibility, visibility and usability in learning spaces. Tessa takes this view based on considerable experience of inheriting, and having to put right, badly designed learning spaces. She told us *"All of my pain is in here. I have inherited all of these mistakes and learned from every one"*.

Throughout her career Tessa has seen many examples of poor learning spaces across the sector. She believes that if the principles outlined in the Toolkit had been applied at the design stage, many institutions would have realised that that some of those areas could never be teaching spaces.

Elsewhere in this Toolkit we look at making investment decisions and suggest that upgrading ten rooms with minor problems might be cheaper and more worthwhile than the investment required to adapt a space with significant design issues.

### 4.3 Functional room standards

For every separate *room* or zone within a learning space you will need to understand the activities that will be going on in the space in order to determine the functional specifications to be met. The overall shape and configuration of the space may be a major factor in determining what is possible e.g. if there are columns to support the ceiling or if the shape of the space is awkward. This section assumes you have reached the point where you are specifying the detail of a room that is generally adequate for the intended activities.

Sometimes all it takes is a little bit of ingenuity to turn an unsatisfactory space into a highly functional one. Paul Burt, Learning Spaces Service Owner, University College London (UCL), told us *"If you have a room that is already long and narrow the chances are the end wall will have the door in it and you will also need to find a place for the teacher to stand. The answer is to flip it - the 90° flipped classroom"*.

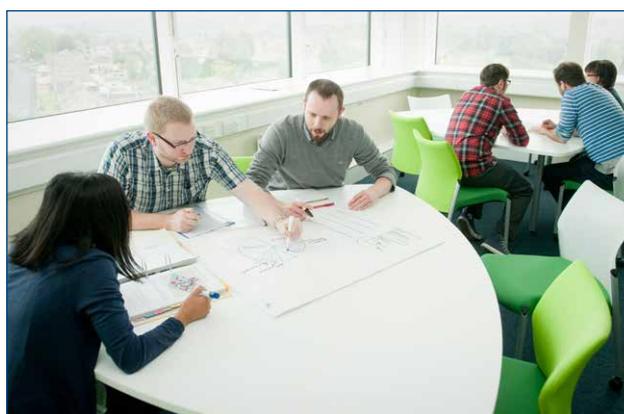


Photo 7: Plextrum shaped tables are particularly conducive to group work. University of Derby.

© University of Derby

<sup>71</sup> Node chairs have swivel seats and adjustable work surfaces. They are easy to reconfigure as they are on castors.

In the case of large spaces you may need to break the area down into a series of individual zones with different requirements. At an early stage in the planning process you should capture the basic requirements for each space. The headings you will need to consider include:

- activities to be carried out;
- general design criteria;
- specific technology or equipment requirements;
- services to be provided in the space.

We have already said that usability is a key design principle for all learning spaces and we must keep that in mind at all times. In the majority of rooms users should generally be able to do what they want to do without having to undergo training or read a lot of instructions. Matt Sherlock told us *“Everything has to be **appropriate** and this is a keyword that should feature in the Toolkit. It can also be innovative but being appropriate is key”*. It is possible to design rooms that are intuitively usable.

Technology can be used to provide such information and support as may be needed, for example, at the University of Birmingham QR codes<sup>72</sup> in every teaching room link you to all of the information about that room including the timetable and instructions for using the equipment. The learning spaces team would like to extend this to provide a very easy means of fault reporting. Matt Sherlock says *“It is frustrating to hear somebody say ‘something isn’t working and it wasn’t working last week either’ i.e. they didn’t report it”*.

A number of contributors to this Toolkit talked about norms in terms of the amount of space per student for different types of activity. Some said their institution had a clear focus on trying to increase the amount of space per student whereas others thought there was a risk of space norms going *out of the window* if over recruitment occurs due to the lifting of the student numbers cap. Financial imperatives to reduce the amount of space per student may be at odds with the educational principles we have outlined to better support active learning. As one of our Toolkit contributors put it: *“Don’t crowd students out - they won’t turn up to classes”*.

A number of years ago, the University of Birmingham created an “overspill” facility to accommodate fifty medical students that could not be accommodated in the largest lecture theatre available. A great deal of effort was made to make the students using this space feel they were getting the same experience as if they were actually in the lecture theatre but, within three weeks, the facility was unused and the students squeezed themselves into every available space in the lecture theatre, on stairs and on the floor at the front of the room. The response was to build a new, larger lecture theatre.

Consideration of the above will allow you to start defining the specification more precisely.

The main areas you are likely to look at are:

Area	Specifications to be covered
Finishes	Floors; walls; ceilings; windows; doors; acoustic treatment; decoration
Mechanical and electrical	Electrical (including any machinery with specialist power requirements); data; heating; lighting; ventilation; plumbing
Fixtures and fittings	Furniture; equipment; audiovisual equipment; security requirements; storage requirements

Ultimately you will require some form of space data sheet for every individual space that goes into precise detail on all requirements, down to the level of number and position of power sockets and the need for small equipment such as waste and recycling bins, clocks etc.

There are no universal standards as regards access control and attendance monitoring in learning spaces but you should consider local policy and likely future requirements at the design stage.

These are some of the things the Toolkit contributors told us about functional room standards:

<sup>72</sup> [https://en.wikipedia.org/wiki/QR\\_code](https://en.wikipedia.org/wiki/QR_code)

- Doors onto learning spaces should, where possible, contain glazed vision panels so people can see if there is a teaching session in progress and to minimise the risk of accidents. Students also like to retain a connection with the *outside world* and there are considerations of safety, security and the university's duty of care for students working alone in a room.
- All teaching spaces should have a working clock visible to the tutor. A traditional clock face is more readily interpreted than a digital numeric display.
- For genuinely flexible spaces, staff and students need to be able to move furniture easily e.g. put tables together to create different shapes and layouts. Lightweight and stackable furniture may be most practical, which may run counter to usual purchasing policy of selecting furniture that is more robust, but less easy for staff and students to move.
- Bigger is not necessarily better when it comes to table space for group work. The University of Edinburgh tested some six seater tables (shaped a bit like an ironing board) for group work by creating models in four different widths and testing them in the library. It might have been expected that students would prefer the widest tables but it was found that the bigger desks resulted in problems with noise levels as people talking across the large tables were louder.
- Plectrum shaped tables have been found to be particularly effective for group work.

#### 4.4 Heating, ventilation and cooling (HVAC)

Heating, ventilation and cooling (HVAC) tend to be linked, although in building systems terms they can equally be provided independently. They are fundamental to user comfort and hence the perception of the usability of particular space. Physical and psychological responses to one can be affected by another (air movement affects the sensation of air temperature on the skin and provision of adequate fresh air is critical to mental alertness and concentration). Furthermore, there is considerable difficulty in providing air temperatures which are acceptable to everyone, as different individuals respond differently (it is acknowledged that women are generally more sensitive to cold than men). This can make it difficult to be precise as to what is required and what is being experienced, and may lead to confusion and sometimes mistrust (of those who operate, designed or installed the system).



*“Environmental factors are absolutely fundamental. When you ask students about learning spaces, being too hot or too cold and having uncomfortable seats is always the first thing they talk about. The key thing is that students want to feel relaxed and they don't feel relaxed in many of our learning spaces. This inhibits their ability to learn.”* Toolkit contributor

A study on the management of open plan learning spaces (Watson *et al* 2007<sup>73</sup>) found that HVAC represented the top issue for managers of such spaces. Issues included the perceived inadequacy of most systems and frustration at lack of local control. This was often articulated as a tension between the managers of the space and the estates or facilities department that managed the system and highlights the importance of achieving a common understanding between all departments involved in making such spaces work. The study also found that complaints to do with HVAC most often came where changes had been made to the internal partitioning of large spaces that were originally designed as open plan.

Open plan areas work on the principle, generally, of there being uniform temperatures across the total space. Temperatures at the perimeter of a large space (where there is going to be the greatest heat loss and heat gain and sudden changes in outside temperature) will be more variable and might not be able to be fully compensated for by a uniform HVAC system.

Ideally HVAC systems should be designed with considerable variability in mind (by providing zones which can cater for locally changing conditions). This does however make them more expensive, and sophistication in air conditioning is often first to be trimmed from the cost plan. However a space is originally designed, the fact that internal changes will inevitably occur should therefore be taken as fact and as an essential requirement for flexibility within a building.

*Full air conditioning* implies modification of the quality of the air in terms of fresh air content, temperature and humidity. Often however what is called air conditioning involves little more than *comfort cooling* i.e. recirculating and

<sup>73</sup> Watson, L, Anderson, H. and Strachan, K. (2007) *The Design and Management of Open Plan Technology Rich Learning and Teaching Spaces in Further and Higher Education in the UK. Report produced for Jisc: [www.webarchive.org.uk/wayback/archive/20080925103236/http://www.jisc.ac.uk/whatwedo/themes/elearning/tele/managinglearningspaces.aspx](http://www.webarchive.org.uk/wayback/archive/20080925103236/http://www.jisc.ac.uk/whatwedo/themes/elearning/tele/managinglearningspaces.aspx)*

cooling the internal air. This is sometimes provided in the theoretical belief that it will be combined with openable windows, which will provide the fresh air component. In practice however the external windows prove difficult physically or managerially to open, resulting in a dearth of fresh air. Such environments feel stuffy and result in a loss of concentration.



*“Economies to the air conditioning design would appear almost always to prove to be false economies, resulting in the greatest reason for user dissatisfaction.” (Watson et al 2007<sup>74</sup>)*

The difficulty of meeting the requirement of responsiveness to individual preferences can result in a *Catch-22* situation: frustrated building occupants tamper with controls thereby upsetting the system’s balance and this in turn can result in the deliberate removal of local control, further aggravating user frustration.

It is significant to note that an important factor in the analysis of *Sick Building Syndrome* was found to be lack of personal control. As a result of this the reintroduction of openable windows and thermostatic radiators has become a more familiar feature of modern buildings, being considered preferable to the centralised control and uniform provision of full air conditioning. Reasons this may not be practical include a noisy or polluted external environment or security risk.

The concept of passive heating and cooling systems has featured heavily in the design of many new buildings, not least because such systems are believed to fit with the sustainability agenda. This often involves air movement across open plan floors and up through an open atrium. Again changes in the configuration of the building such as closing off some areas can have a detrimental effect on the working of the system. Watson et al<sup>75</sup> issued caution in the use of such systems and noted “...noise, smells, variations in temperature, and the inability to adapt the building were starting to render the building unusable and were clearly an unacceptable price to pay in the name of sustainability”. They went on to say: “So limiting was the operation of some of the buildings visited, that it was concluded that sustainable design should be treated with extreme caution at the early stages of any project”. They suggested that mixed mode or blended systems where the feeder air routes could be adapted or modified through the use of mechanical fans or with certain spaces dealt with by localised artificial systems offered for greater flexibility and were found to be far more successful than solutions that emphasise sustainability above all else.

- In spaces where it is practical it should be possible to open windows for natural ventilation.
- Space designers need to acknowledge that individuals respond differently to environmental factors and provide, if possible, a degree of local control over them.
- The implications of passive heating and cooling systems need to be carefully thought through particularly in terms of the potential for future changes to building layout and use.
- Controls for air conditioning are notoriously complex for end users and clear instructions should be produced and positioned alongside the controls.

## 4.5 Lighting

The provision of adequate and glare free artificial lighting is relatively simple, but maximising natural lighting and providing good lighting that meets the needs of all users and enhances the ambiance of a particular learning space is less easy.

Where possible learning spaces should permit controlled admission of daylight. The psychological benefit of natural light is widely accepted<sup>76</sup>. In terms of management however it can pose difficulties. It can be too bright, causing glare which makes it inappropriate for computer screens or even conventional text reading. Natural light therefore needs to be regulated in combination with blinds or (preferably) external fixed or movable louvres where the shading provides the additional benefit of minimising heat gain. External systems are more expensive however, more difficult to maintain and difficult or inappropriate to retrofit to an existing building. Very often therefore best use has to

74 Watson, L, Anderson, H. and Strachan, K. (2007) *The Design and Management of Open Plan Technology Rich Learning and Teaching Spaces in Further and Higher Education in the UK. Report produced for Jisc: [www.webarchive.org.uk/wayback/archive/20080925103236/http://www.jisc.ac.uk/whatwedo/themes/elearning/tele/managinglearningspaces.aspx](http://www.webarchive.org.uk/wayback/archive/20080925103236/http://www.jisc.ac.uk/whatwedo/themes/elearning/tele/managinglearningspaces.aspx)*

75 Watson, L, Anderson, H. and Strachan, K. (2007) *The Design and Management of Open Plan Technology Rich Learning and Teaching Spaces in Further and Higher Education in the UK. Report produced for Jisc: [www.webarchive.org.uk/wayback/archive/20080925103236/http://www.jisc.ac.uk/whatwedo/themes/elearning/tele/managinglearningspaces.aspx](http://www.webarchive.org.uk/wayback/archive/20080925103236/http://www.jisc.ac.uk/whatwedo/themes/elearning/tele/managinglearningspaces.aspx)*

76 See for example: <https://stevemaslin.wordpress.com/2015/04/29/clear-as-daylight/>

be made of internal blinds. Another option is *encapsulated* blinds between the primary and secondary glazing which are particularly suitable for non-opening windows.

*Adequate lighting* which permits easy reading of text and computer screens but which is otherwise uniform can dull the atmosphere of a learning space. Good lighting should provide variety in support of different types of activity. Differences in personal requirement with respect to lighting can be relatively easily dealt with at the level of *task lighting*.

A particular facilities management issue arises with respect to lighting in the need to have easy access to light fittings to be able to change light bulbs. This can be a problem specifically with feature lighting where it is often combined with double height or atrium spaces. The implications of certain designs are not always appreciated in advance.

Where sustainability is not already being met by maximising the use of natural light, there is a need to ensure use of low energy fittings. These can have the added benefit of being long life thereby reducing the problem of access.

These tips and detailed specifications for lighting (in space that is used for formal teaching sessions) are adapted from University College London Learning Space Guidelines<sup>77</sup>:

- There are recognised specifications giving minimum lux levels for different types of activity and these should be followed.
- Lighting design in learning spaces should enable presenters and students to see (sufficiently for note taking) and be seen. Placement of lights in relation to projection and/or writing surfaces requires care: a common mistake is the positioning of a light directly above the projection surface which results in uneven image contrast.
- Low energy lamps that require more than ten seconds to reach maximum brightness are not suitable in learning spaces due to the frequent need to change between different lighting states within a taught session.
- Lights specified for new or refurbished learning spaces should give high frequency (no flicker) light output. General area lighting should have a colour resembling daylight whereas breakout or small group learning spaces may benefit from a directional pendant that focuses warmer light on the centre of the discussion area.
- Lighting controls should be available close to the entrance in all learning spaces unless occupancy sensing is used. For larger spaces secondary controls in proximity to the teaching facilities are required so that the lighting can be optimised by the lecturer for different sections of the session.
- Ideally a range of lighting levels and disbursement patterns should be selectable by the user of the space. Lighting controls should be clearly labelled, ideally with illustrative lighting pattern diagrams.
- Controls and switching should permit separate control of the lighting above projection and writing surfaces in relation to the other lighting zones in the space.
- With the increasing use of lecture capture technologies it is important to understand the lighting requirements in relation to all the visual resources that will be used a particular session.
- If occupancy sensing is used to avoid energy wastage it is important that the sensor technology is capable of detecting static occupancy as well as movement because a lecture audience or students taking an exam may move very little.
- Care should be taken in the choice of fluorescent lights as learners using tablet computers can experience harsh reflections due to the horizontal angle at which tablets are used.



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*Photo 8: At different times of day this is a quiet study space, a busy cafeteria or a venue for events: fixed and projected lighting change the ambience. The University of Porto's e-learning café.*

<sup>77</sup> University College London Learning Space Guidelines v.1.1.2, Information Services Division (2014): [www.ucl.ac.uk/isd/services/learning-teaching/spaces/documents/ucl-learning-space-guidelines.pdf](http://www.ucl.ac.uk/isd/services/learning-teaching/spaces/documents/ucl-learning-space-guidelines.pdf)

## Resources

- The Jisc learning spaces guide (2013) has some examples of lighting solutions in a range of learning environments<sup>78</sup>.

### 4.6 Considerations for particular types of learning space

Functional room standards vary according to the particular types of learning activity to be carried out in a space. Here we take a broad look at the major considerations for some common types of formal teaching space. We have not included libraries or specialist spaces such as laboratories and spaces dedicated to performance art, but you can find some examples of good practice in specialist spaces amongst our resources.

A set of guidelines based on published space norms by AUDE<sup>79</sup>, RIBA and sector leading universities identify the need to provide sufficient space per person depending on the activity planned. Apart from meeting pedagogic requirements this also takes into account health and safety regulations for fire safety evacuation:

Lecture theatre = 1.1-1.25 sq.m per person

Interactive lecture theatre = 1.7-2.0 sq.m per person

Seminar room = 2.2-2.50 sq.m per person

IT cluster rooms = 2.75 sq.m per person

#### 4.6.1 Interactive lecture theatres

Despite the trend noted in Section 1, Building a new pedagogy, towards learning becoming more social, active and collaborative, a significant amount of university teaching still takes place in the traditional setting of the lecture theatre. What has changed however is that advances in technology and space design offer increased opportunities to make lectures a more interactive learning experience.

Rows of fixed seating are being replaced by sofa type seating that position students in small groups, or swivel seating so that students can turn and work with others. Where this swivel seating is used, attention needs to be given to the relative positioning of the seats. Positioning both front and rear seats on a particular tier in direct alignment will obscure the view of the rear seat occupant. There is also a need to ensure that there is sufficient space between the two rows on the same tier to avoid students being uncomfortably close when in discussion mode.

Even in lecture theatres where seating is laid out in conventional rows, consideration should be given to improving sight lines by staggering the seat positions between rows. Lecture theatre seating should be of high quality and be comfortable for extended occupancy periods and upholstery should be chosen for durability and longevity. Each student seat should be provided with a horizontal surface that is sufficiently large to permit the use of a paper pad or laptop for taking notes.

Technologies such as personal response systems (also known as electronic voting systems (EVSs) or clickers<sup>80</sup>) permit students to interact with the lecturer. For more on this topic, see Section 5, Learning technologies.



Photo 9: Swivel seating is used in the interactive lecture theatres at City University.

© City University

<sup>78</sup> Jisc Learning spaces guide (2013) [www.jisc.ac.uk/guides/learning-spaces/lighting](http://www.jisc.ac.uk/guides/learning-spaces/lighting)

<sup>79</sup> AUDE (2010) Space Assessment Models and Space Profiles: [www.aude.ac.uk/documents/samuserguide/](http://www.aude.ac.uk/documents/samuserguide/)

<sup>80</sup> Electronic voting systems (EVSs), also known as personal response systems (PRSs) or clickers, are a classroom based technology which can be used to support learning, teaching and assessment by allowing students to select a response to multiple choice questions.

With more and more students using digital technologies during class there is an increasing demand for power supplies in lecture theatres. Universities are taking different approaches to meeting this demand: some are building new lecture theatres with power to every seat, whereas others, predicting a future decrease in demand as battery performance continues to improve, are choosing to provide a more limited amount of power sockets. University College London has taken the approach of only providing power to the first two rows in a lecture theatre to encourage students to move to the front.

## 4.6.2 Active learning classrooms

We are using the term classroom to describe rooms used for a range of formal, directed learning activities that may include approaches such as:

- Inquiry based learning;
- Problem based learning;
- Discussion based learning;
- Student led interactive learning;
- Simulation based learning<sup>81</sup>.



*“The cultural change required in thinking of space in a new way should not be underestimated. We need to ask such basic questions as ‘Should rooms have a front and a back?’ Spaces should center on learning, not experts”.* (Van Note Chism 2006<sup>81</sup>)

Applying a socio-constructivist philosophy challenges the notion that a classroom should have a clearly defined *front* or what Van Note Chism (2006) describes as a privileged space. Many innovative classroom spaces are effectively decentred. Most classrooms do nonetheless have a primary focus direction where it makes sense to concentrate the teaching facilities and displays, often referred to as the *teaching wall*.

Adaptability is vital in these spaces so that a group of learners can easily move from listening to one speaker to working in groups or working independently. The flow of activities needs to be seamless so it makes sense to have tables and chairs capable of quick reconfiguration to support different kinds of activity. Guidance illustrations of exemplar layouts with the furniture supplied should be available in the space and on the room bookings website. Layout can have an impact on group dynamics e.g. the traditional layout of rows of chairs allows certain students to hide at the back and avoid participation in class activities.

Researchers have explored the psychological and educational effects of classroom density, both spatial (the size of the room) and social (the number of students). Graetz (2006)<sup>82</sup> suggests a good social density benchmark for classrooms is three to five groups, of six to twelve students each. Designers should also pay attention to the risk of overcrowding in classrooms. Research suggests that students can be expected to work together effectively at distances of 0.6-1.2 m between individuals and 1.2-2.1 m between tables, without feeling crowded. Both students and instructors should have enough room to move easily from group to group.

Comfortable furniture has often been seen as a luxury for students but furniture design, and hence, bodily comfort, can impact on learning. Chairs need to be comfortable, moveable and allow students to turn in different directions, flex their backs and move. Consideration needs to be given to catering for a range of body sizes and accessibility (for example, whether left handed students have appropriate facilities for note taking and laptop use). It has also been suggested that a waterfall front seat edge is better than a right angle for circulation and comfort. James Rutherford, University of Birmingham, in studying for a related master’s degree found there was little research into table design but what there is suggests that non-rectangular tables promote collaboration and reduce confrontation.

In spite of the value of digital devices to support learning, they also provide many distractions in the classroom e.g. common instances of students checking social media or playing online games during lessons. Graetz (2006)<sup>83</sup> suggests that attempting to prohibit the use of devices in class through edict or infrastructure (for example, installing an internet kill switch) is costly and does little to address the underlying problem. Space design is of relevance here and a better approach may be to ensure that laptop screens should be easily visible to tutors as they walk around the room. Tutors must be able to engage students in the learning process during class time, and learning spaces must be

<sup>81</sup> Van Note Chism, N. (2006) *Challenging traditional assumptions and rethinking learning spaces* in Oblinger, D.G. (ed) *Learning Spaces*. Washington DC: EDUCAUSE: [www.educause.edu/research-and-publications/books/learning-spaces](http://www.educause.edu/research-and-publications/books/learning-spaces)

<sup>82</sup> Graetz, K. A., ‘The Psychology of Learning Environments’, Oblinger, D.G. (ed) *Learning Spaces*. Washington DC: EDUCAUSE: [www.educause.edu/research-and-publications/books/learning-spaces](http://www.educause.edu/research-and-publications/books/learning-spaces)

<sup>83</sup> Graetz, K. A., ‘The Psychology of Learning Environments’, Oblinger, D.G. (ed) *Learning Spaces*. Washington DC: EDUCAUSE: [www.educause.edu/research-and-publications/books/learning-spaces](http://www.educause.edu/research-and-publications/books/learning-spaces)

designed to facilitate that engagement: it is difficult for students to attend to other activities when they are talking to a tutor, working on a group activity, or using their devices for academic purposes.

Given that adaptability is key to the use of these spaces it should be facilitated temporally as well as spatially i.e. the scheduling of room bookings must allow sufficient time for a change of room configuration between classes. The provision of ubiquitous wifi, the prevalence of user owned portable devices and the high degree of mobility of modern furniture makes this a much easier problem to solve than it was only a few years ago e.g. the use of node chairs<sup>84</sup> as commonly used at City University. The issue nowadays is as much about staff development and encouraging academic staff to make full use of all of the opportunities available to use a variety of collaborative learning and teaching practices.

The Singapore Management University is trialling a new *Active Learning Classroom* that has no formal or prescribed layout. The tutor arrives, creates whatever layout they need that session and at the end they, and the students, move the furniture to the side of the room so that the next tutor can come in and decide what they need. This challenges the situation where tutors just accept the layout they are faced with<sup>85</sup>.

### 4.6.3 Computer rooms

By computer rooms we mean rooms with desktop computers that support some or all of the following functions:

- taught sessions that include a significant element of IT usage by students;
- providing computer and associated facilities for self directed use by students to support their learning;
- electronic individual examinations (e-assessment) which are usually taken under invigilation.

Some computer rooms perform all these functions at different times whereas some may be open access facilities that are not bookable for teaching purposes.

Audio reinforcement and assistive listening technology may be necessary in rooms used for teaching due to the additional ambient noise created by computer fans and the additional heating, ventilation and air conditioning (HVAC) required in rooms with many computers.

Many existing computer rooms are densely packed which provides little opportunity for collaborative learning and makes circulation around other users in the space difficult. Accommodating the maximum number of workstations in a space is often a priority but the assumption that the density achieved with straight rows is much greater than any other layout should be questioned and alternative layouts investigated. Sightlines and security may be significant issues especially if the room is to be used for examinations.

The choice of computer type should be considered in relation to security, the aesthetics of the space and the possible impact of base units on students needing to work collaboratively at a single computer. All in one units may provide the best solution provided they can be adequately secured.

Each computer workstation should be set up so the user is in the correct ergonomic posture. Design and dimensions of computer workstations in offices are legislated through the European Display Screen Equipment Directive (90/270/EEC) and dimensions for workstations should comply with British Standard EN 527-1:2011. Computer monitors (or the whole computer if an all in one unit) should be mounted in such a way to facilitate easy tilt and height adjustment of the display by the user and chairs should be standard rotatable, castor mounted and adjustable.

## Resources

- The Learning Space Toolkit<sup>86</sup> (produced by North Carolina State University (NCU) Libraries and its Distance Education and Learning Technology Applications (DELTA) in partnership with brightspot and AECOM) has an Integration Blueprint<sup>87</sup> which can be used to compile information about activities, spaces, technology and services to aid the design process. A worked example is also available<sup>88</sup>.

<sup>84</sup> Node chair animation: [www.youtube.com/watch?v=5Q9uMb0CG7o](http://www.youtube.com/watch?v=5Q9uMb0CG7o)

<sup>85</sup> <http://blog.nus.edu.sg/citations/tag/active-learning-classroom/>

<sup>86</sup> <http://learningspacetoolkit.org>

<sup>87</sup> [https://docs.google.com/document/d/19Ov6jC1ZpQJB\\_yvaEFDGixFeLQj1TbgdgD50oambg0/edit?pli=1](https://docs.google.com/document/d/19Ov6jC1ZpQJB_yvaEFDGixFeLQj1TbgdgD50oambg0/edit?pli=1)

<sup>88</sup> <http://learningspacetoolkit.org/wp-content/uploads/Integration-Blueprint-Example.pdf>

- This space data sheet template is based on a model created for a newbuild at Edinburgh's Telford College and makes a distinction between equipment to be transferred from the old building and purchase requirements<sup>89</sup>.

## 4.7 Audio standards

This section is founded on the premise that all users of the space must be able to hear what is being presented and be able to hear and participate in group discussions.

Different learning spaces require different treatments e.g.:

- a lecture theatre will require sound reinforcement to enable all learners to hear;
- an open plan group working space will require sound to be deadened to contain the need of learners to speak up over the background noise;
- a library must be insulated from external noise;
- areas adjacent to a learning space emanating noise (e.g. a music room) must be protected from that noise.

You will need to be clear about the sources of sound before you start to design the space. As well as noise generated by building users and their activities, you may also have to protect against noise produced by heating ventilation and cooling systems.

The layout of the space and the choice of materials used will impact how sound travels in space. As a beginner's guide to noise there are two aspects that you need to think about:

### ***Insulation***

Insulation against noise stops transmission from one space to another. It is difficult to make a lightweight material insulate against sound. Good acoustic insulation is provided by mass, so one centimetre of concrete will provide better acoustic insulation than one centimetre of plasterboard.

The downside of this is that dense materials may stop noise well but, if noise is made by impacting the material, then the dense material will also transmit noise very effectively. For example if there is impact on a concrete floor and this surface is contiguous then the noise will transmit along the surface and transmit effectively to spaces that share the floor.

Only a full height wall will provide full acoustic separation and, where this is necessary, the process has to be followed through completely: walls should be sufficiently solid; walls should penetrate both the ceiling void and the floor void and wall penetrations, like ventilation ductwork, should be fitted with sound attenuators. Costs can mount and benefits have to be clearly articulated in order to be justified.

### ***Absorption / diffusion***

Noise can be absorbed or reflected so that reverberation can be reduced. Absorption of sound occurs when sound hits the surface and is not reflected but enters the material and goes no further. Diffusion surfaces may be required for particular acoustic performance. Examples of surfaces that are good at absorption are carpets and fabrics in the form of pin boards and furniture.

Ceiling finish has been found to have the greatest impact on the acoustic properties of a space. An *industrial look* (with hard ceilings and exposed ventilation ducts) is currently very fashionable but very bad acoustically in a learning space. Suspended ceilings with ceiling tiles have much better acoustic properties.

Given the importance of how sound is controlled and managed to the usability of your learning space you might want to consider employing an acoustician to help model the noise within the space you are planning and to advise on floor, ceiling and wall finishes. Acoustic insulation is often something that is compromised when budgets begin to escalate and savings need to be made but this can be a false economy as mistakes can be costly to rectify afterwards. Good professional advice at an early stage should help avoid these types of mistakes.

<sup>89</sup> <http://bit.ly/sps-example>

## Assistive listening systems

There are three types of assistive listening systems; they all require a microphone of sufficient quality to relay a signal to the systems.

**Induction loop systems** – under floor installation is advised wherever possible to ensure standard compliance. Whilst there can be issues around cut tape when replacing flooring they can be proactively managed by writing a damages clause in to the flooring contractors' contract. Ceiling level installations are considered undesirable and should only be considered as a last resort as:

- they are usually further from head height therefore more power is required;
- metal losses are usually higher within a ceiling therefore more power is required;
- installation of array systems is much more difficult at ceiling level.

The presence of an induction loop should be signalled by the use of the international symbol:



**Infrared systems** – involve a transmitter (there must be line of sight from the transmitter to the receiver) which is worn round the neck. They work well where there are high ceilings but clearly identify someone as hearing impaired. If you use this system then the university should issue hearing impaired learners with their own receiver and make the receivers available to visitors. Some institutions issue these from the main reception desk.

**Frequency modulation systems** – require licenced FM bands, are expensive, identify the user as hearing impaired and require thorough hygiene routines. For these reasons this is not a recommended approach.

### Hints and tips:

- Do not place multi directional microphones near noise sources such as projectors or HVAC systems.
- Do not attempt to rectify poor acoustic performance without considering a potentially lower cost of moving the location.
- Physical routing of lighting and audio cables and locations of fittings should be considered, and as far as possible separated, to avoid problems such as light dimming causing interference with audio. Parallel routings of cables should be avoided. Power sources for audio and environmental services, such as lighting and HVAC, should ideally be phase separated and ground connections for audio dedicated (i.e. not shared with anything else in the building).
- The scraping of chairs across floors has been identified as a major source of noise in a number of buildings and the most straightforward way of dealing with this is to fix rubber stoppers to the bottom of chair legs.

### Resources

- Acoustic performance standards set by the Department for Education<sup>90</sup>.
- The InfoComm Audio Coverage Uniformity standard is a widely recognised commercial standard and copies can be purchased<sup>91</sup>.

<sup>90</sup> [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/400784/BB93\\_February\\_2015.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/400784/BB93_February_2015.pdf)

<sup>91</sup> [www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/32930.htm](http://www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/32930.htm)

## 4.8 Visual standards

This section is founded on the premise that users of the space should be able to see what is being presented.

Ensuring the visibility of resources used for learning and teaching has long been a significant issue as the layout of many university buildings, whether a historic campus or a 1960s building with concrete pillars, is often not conducive to good sightlines. The increasing flexibility and affordability of technology does however make these problems easier to solve, for example:

- Structural columns are often the cause of poor visibility of presentations. Repeater screens mounted on the pillar can resolve this.
- Where you have long spaces with low ceilings, the head of the person in front will obstruct the view. Turning the space 90° and using dual projection can help. You might also be able to use repeater screens for the back rows (due to the height restrictions it may be necessary to set these into the ceiling void if one exists).

The legibility of material on vertical writing surfaces is constrained by the size that someone can write with natural fluidity. Technology can provide solutions to this issue in the following ways:

- use of visualiser<sup>92</sup> as a horizontal writing surface;
- use of touch sensitive fixed display monitor (for example a Smart Sympodium<sup>93</sup>);
- use of an interactive whiteboard with its display duplicated onto a larger projection surface;
- use of a portable tablet device with its display mirrored onto a larger projection surface (possibly via the fixed teaching station PC).

### Visual design guidelines

- The dimensions of the projected image in learning spaces should be proportional to the viewing distance. The maximum acceptable viewing distance (or conversely the minimum image size) is however dependent on the type of material being shown. A demonstration of how to use a software application such as Excel will require students to be able to see much finer detail than a few bullet points on a PowerPoint slide.
- Older rules of thumb such as “*No learner should sit further away than six times the diagonal measurement of the screen*” need to be revised as the arrival of HD displays and the emergence of the newer 4K resolution displays means higher resolution where computer interfaces tend to display smaller. Similarly the 4:6:8 rule (whereby the minimum image height should equal the maximum viewing distance divided by a factor of 4 for Excel, 6 for PowerPoint or 8 for videos) is problematic unless the room is only used by a single tutor who presents a single type of material. No learner should have to turn their head to an extreme angle. In general a cone of viewing giving less than 45° angle to the centre of the screen gives a good viewing experience whereas a viewing angle within 45° of the near edge of the screen gives an acceptable viewing experience.
- No learner should have to look upward to the top of the screen more than 35° or 15° to the screen centre (in order to avoid neck strain).
- The base of the displayed image should be 1200mm from the floor for standard throw projectors but the height should be reduced to 1000mm from the floor if the display is to be interactive i.e. when an ultra-short throw projector with interactive functionality or a specific interactive whiteboard is used. The rationale for the different floor to screen heights is that 1200mm above finished floor level would usually allow most of a seated audience in a flat floored space to see the base of the image. However this height is typically too high for use as an interactive writing surface as the upper portions of the screen will not be reachable by most teachers. If ultra-short throw projectors are installed it should be noted that these could be retrospectively fitted with interactive capabilities and thus thought given to the optimum mounting height.
- Do not place a teaching point in front of the projector, it risks causing glare to the lecturer and obscures the students’ view of the presentation.

<sup>92</sup> Visualisers may be described as digital overhead projectors (OHPs). See Section 5, Learning technologies, for a more in-depth description.

<sup>93</sup> <http://home.smarttech.com/>

- Ensure that there is line of sight for the learners in the back row.
- Ensure that the lights above a projected surface can be turned off or are dimmable independently from the rest of the space. Ensure that learners can work whilst the teaching wall is still visible.

### Hints and tips:

- The provision of confidence monitors at the front of the room, facing the tutor (but not obstructing the student's view) will enable the tutor to see what is being presented without the need to turn their back on the audience.
- North facing teaching walls will not be troubled by sun, others may well require blinds.
- Use security measures such as an anti-tamper alarm or anti-theft bolt fixings to protect equipment such as projectors.
- Ensure that the stability of the image from a ceiling mounted projector will not be affected by footfall in the room above or by its proximity to other services such as heating, ventilation and cooling. Similarly with wall mounted projectors the image can be affected by closing doors etc.
- Ultra Short Throw (UST) type projectors are useful in smaller learning spaces. Whilst limited in terms of maximum image size, they have the benefit of not suffering from a *hot spot* reflecting back to users and the instructor will not obstruct the projector beam if standing in front of the board nor be dazzled by it.
- In certain situations large LCD or LED flat panel displays may be more suitable as the primary display or used in conjunction with the data and video projector to provide secondary displays for those seating positions that cannot easily view the main display. Ideally the aspect ratio and display resolution of flat panel displays should match the aspect ratio of the computer monitor and projector image.
- A challenge in larger spaces is facilitating a method for the instructor to write or illustrate and those markings to be clearly seen by the students. Conventional whiteboards have a workable height range between 1000mm and 2000mm depending on the height of the lecturer. Column track mounted boards enable the lecturer to expand this workable height as the lecturer can easily raise a board to make it more visible to students whilst continuing to write on the second board below. Use of a visualiser may also help in some cases.
- If you use the same surface for projection as writing then there is a trade off to be made. Boards that clean are reflective, boards that do not reflect cannot be cleaned with dry wipe, so are unsuitable for writing.
- Display panels with a soft screen surface should be avoided because of the risk of accidental or intentional damage.

### Resources

- University College London Learning Space Guidelines<sup>94</sup> gives general guidance on the design of rooms used for teaching and contains comprehensive discussion of the types of audio visual facilities suitable for different types of space.
- InfoComm is the trade association representing the professional audio visual and information communications industries worldwide and it provides industry standards for audio visual systems including AV/IT Infrastructure Guidelines for Higher Education - the Display Image Size for 2D content (this standard was in development, as a working draft, at time of writing)<sup>95</sup>.
- The Association for Audio Visual and Education Technology Management (AETM), Australia has useful and well researched guidelines on integrating AV systems into learning spaces<sup>96</sup>.

<sup>94</sup> University College London Learning Space guidelines v.1.1.2, Information Services Division (2014): <http://www.ucl.ac.uk/isd/services/learning-teaching/spaces/documents/ucl-learning-space-guidelines.pdf>

<sup>95</sup> [www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/35973.htm](http://www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/35973.htm)

<sup>96</sup> [www.aetm.org/av-design-guidelines](http://www.aetm.org/av-design-guidelines)

## 4.9 IT standards

This section focuses on the IT considerations that have most impact on learning space users. Technical infrastructure requirements do of course amount to a lot more than this. Most institutions will already have detailed infrastructure guidelines and these should be followed as, in this sense, there is nothing different about learning spaces. There are also certain standards that need to be met in relation to building regulations. Most of these relate to protection against fire and the thermal integrity of the space. A common problem is leaving holes between different fire containment areas when putting cables through. There is a need to make sure that all holes are sealed up and that no smoke cabling is used: LSZH (Low Smoke Zero Halogen) is the building regulations requirement for plenum environments. Your specialist advisers should be well aware of these issues. The IT elements that impact specifically on learning include:

### Wireless (wifi)

We have placed wifi at the head of this section because its provision is one of the factors that has the greatest impact on building users. Wifi network connectivity should be viewed as a basic requirement of any learning space regardless of whatever other technology is in the room.

Guaranteed 100% coverage is now probably the minimum requirement in formal learning spaces. In the past, this may simply have meant ensuring that a satisfactory signal strength was available throughout the space but we must also ensure that the system is designed to accommodate a very high density of users. Assuming one wireless device is no longer adequate, as many students may bring with them a smartphone, a tablet and a laptop and in future years it is likely that more types of device (e.g. cameras, watches) will seek wifi connections.

University College London Learning Space Guidelines suggest that the number of concurrent connections provided for should be five times the maximum number of people expected to occupy the space at any one time. It could be argued that five times is perhaps overkill, in particular in large lecture theatres (for a 400 seat lecture theatre, do we really need to make provision for 2000 devices?), but it is clear that in an IT enabled environment, the number of devices is likely to be well in excess of the number of participants. The shared nature of wireless means the additional bandwidth is not wasted and provides a better service for those in learning spaces not utilised to capacity.

The nature of wireless use in teaching spaces is also changing. Whereas previously a lecturer may have projected a video clip in the room, they may now suggest that each participant should access that same material from YouTube on their mobile device.

Providing pervasive wireless coverage in large lecture theatres and densely occupied teaching spaces provides particular challenges, often requiring specialist design skill to deploy larger numbers of lower powered access points or specialist antennae to ensure uniform coverage without introducing additional interference. One model that has been successfully deployed, especially in green field sites, is having an array of *picocells*<sup>98</sup> located underneath seats.

In all but the simplest spaces, it is essential to do some form of wifi mapping before developing a new learning space to ensure there is sufficient coverage, and minimal interference from adjacent spaces. The design needs to take into account provision in surrounding areas, bearing in mind the *stickiness* of wireless clients, which may attempt to remain associated with an access point even though the student has moved to an adjacent room. You also need to think about outside spaces as well in relation to wifi as students like the opportunity to work outside whenever



*“Good planning is important before a wireless network is deployed. It is important to know how many users will need support, where they will be given access, how they might move around, and their anticipated bandwidth requirement. The network will also need to be designed around the physical properties of the building as the fabric of the building, such as steel columns or foil-backed plasterboard, will affect the range and coverage of the network.” UCISA (2015)<sup>97</sup>*



*“IT demand – especially for wireless - is constantly increasing as it is predominantly consumer-driven, and thought needs to be given to the introduction of newer client technologies, for example, the anticipated growth of 802.11ac<sup>99</sup> client devices.”*  
Bruce Rodger

<sup>97</sup> UCISA (2015) *Secure Network Management*: [www.ucisa.ac.uk/securenetworkmanagement](http://www.ucisa.ac.uk/securenetworkmanagement)

<sup>98</sup> A picocell is a small base station used to extend phone or wifi coverage to indoor areas where outdoor signals do not reach well, or to add network capacity in areas with dense usage.

<sup>99</sup> The IEEE 802 Standard comprises of a family of networking standards that cover the physical layer specifications of technologies from ethernet to wireless [https://en.wikipedia.org/wiki/IEEE\\_802.11ac](https://en.wikipedia.org/wiki/IEEE_802.11ac)

possible. Capacity and coverage are not the only elements to be considered: the architecture and configuration also need to be thought through as continually handing connections between different access points can adversely impact users' devices and battery life. You also need to consider the importance of both university network and mobile phone network coverage. Both of these has an impact on the overall user experience but students may not differentiate between the two, and may blame the university for problems with their mobile phone service provision.

It is important to manage user expectations when deploying any network solution in a densely populated teaching space, especially if using a medium such as wireless which has no service guarantees and is prone to interference from external sources. We design systems using the best available technologies, but we need to remember that any component in the chain – IT or AV – can fail, and teaching styles must be flexible enough to accommodate unforeseen events.

### Management of radio frequency (RF) spectrum

Even considering infrastructure wifi alone, management of the very limited wifi spectrum is a considerable challenge when designing a pervasive and performant network infrastructure.

Many other services involved in delivering a teaching space will want to deploy devices which use this crowded spectrum (especially the 2.4GHz range). Wireless controllers for AV systems, cable free links to projectors and screens, lighting, heating and ventilation controllers, CCTV, access control and alarms - even some radio microphones - can also make claims on this spectrum, and installers often see wireless as the simplest and easiest installation option. It is essential that these competing requirements are all identified at a very early stage and one team is given design authority to address these competing requirements.

Ultimately the student wireless experience is generally the most important factor, and it is often necessary to say “no” to some of the other facilities, insisting on a wired, non-RF solution.

It is important to work with your IT service teams to identify areas of wireless expertise; this may be in house or bought in through specialist consultants and design authorities. Experiences in this area are often discussed on the UCISA Networking Group's<sup>100</sup> Jiscmail discussion list<sup>101</sup> and the WIRELESS-ADMIN Jiscmail list<sup>102</sup>.



*“Wireless technology can be incredibly convenient, but we need to critically enquire whether it is really necessary for every service? Sometimes the complexity, or the potential for interference, outweighs the benefits. A top of the range radio microphone or wireless link to a projector can cost many hundreds or even thousands of pounds, and if it is carefully installed, it can give a performance which can be almost as good as a £5 bit of wire...”*  
Toolkit contributor

This design authority should sit with the IT networking team, who should have the tools and skills to identify and manage RF sources in this spectrum. One university has created an institution-wide policy which states that wifi has been provided mainly for teaching and learning. This means, for example, that if the Estates department wishes to put doors in that are linked to wifi, there has to be a discussion about it first. The critical factor here is that it is essential that conversations take place in the early design phase between the IT, AV and Estates teams to identify any potential conflicts and to ensure that any potential conflicting requirements can be resolved at an early stage, rather than being a surprise during final commissioning.

### Bring Your Own Device (BYOD)

Along with the premise that learning is a social process, we also take the view that learning should not be constrained by time or place, hence mobile devices are an increasingly important way to access learning resources. We have even encountered some institutions questioning whether a fixed PC should be provided in every teaching space or whether a BYOD approach, whereby lecturers bring along their own laptop would get round issues of familiarisation with the equipment. Some institutions have however reported difficulties with connecting a range of devices to projection equipment over eduroam wifi.

BYOD is an important trend, even if the students bringing their own device do not understand the acronym. When providing documentation, advice and guidance, it is important to note that the term BYOD may mean nothing to the intended audience. BYOD is also a different prospect on different types of campus. Students in inner city areas appear less keen to carry laptops around with them than those whose halls of residence are in close proximity to where they taught. Battery life remains an issue for those who do bring devices and many institutions are providing lockers where

<sup>100</sup> UCISA Networking Group: [www.ucisa.ac.uk/groups/ng](http://www.ucisa.ac.uk/groups/ng)

<sup>101</sup> UCISA Networking Group mailing list: [www.jiscmail.ac.uk/cgi-bin/webadmin?A0=ucisa-ng](http://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=ucisa-ng)

<sup>102</sup> [www.jiscmail.ac.uk/cgi-bin/webadmin?A0=WIRELESS-ADMIN](http://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=WIRELESS-ADMIN)

students can charge their laptops<sup>103</sup>. Overall, however, we have yet to find any institution that says BYOD is allowing them to reduce the amount of fixed PCs available on campus. In some cases institutional provision is increasing e.g. the institution is providing a greater amount of borrowable laptops to ensure they are not creating any kind of digital divide between students who own their own devices and those who do not.

When considering BYOD, it may seem intuitive to increase flood wiring provision, delivering high numbers of wired network outlets throughout learning spaces – in floor boxes, or even at every student seat. Experience has shown that this is, in general, not a practical option: BYOD these days inevitably means wireless connections. Many modern laptops, and virtually every tablet device, will not have a wired connection as standard and many wired network connections in large learning spaces, other than in specific teaching positions and specific support locations at the rear of the auditorium, remain largely unused.

### Computers in lecterns?

There are mixed views on whether institutions should install fixed computers at every teaching position.

There are a number of benefits of doing so:

- The lecturer knows there is always a computer available, with network connectivity, so does not have to bring a laptop;
- The software environment is consistent across multiple teaching spaces;
- The computer can have customised features to accommodate specialist facilities in the room (e.g. audience response systems and smartboards);
- The lecturer does not have to worry about interfacing their laptop to the display system.

Installing fixed computing equipment also raises some challenges and support issues:

- The software environment on the centrally provided desktops may not include the specific applications that the lecturer requires;
- Providing and supporting perhaps several hundred additional computers, distributed across the whole institution, is an additional support and financial overhead;
- Authentication for guest and visiting users may present challenges.

The important take away message is to ensure a consistent, well articulated strategy across the entire teaching estate, instead of a hybrid of the above scenarios which will create confusion and mixed expectations.

### Authentication

Every institution will have a high level policy on authentication, authorisation and access to IT systems; this may be based on the UCISA Model Regulations<sup>104</sup>.

These policies will of course apply to their teaching environments. Careful consideration must be given to authentication methods for non-university members, especially if the venue is being used for non-university events. In these circumstances, how does the lecturer log in to the lectern PC while still maintaining an appropriate level of security and audit trail? Stickers on lecterns with login details are not acceptable!

### Standardisation versus innovation

We have heard some tensions expressed around the theme of standardisation versus innovation. In the main however institutions appear to be trying to standardise IT (and AV) facilities for ease of use for users who may teach and learn in a variety of different spaces. A simple way to address this is to work to establish minimum standards that raise the bar and provide a common specification but still allow for innovation.

<sup>103</sup> *The University of Manchester is an example of an institution where laptop charging lockers are in use: [www.library.manchester.ac.uk/services-and-support/students/services/charging-stations/](http://www.library.manchester.ac.uk/services-and-support/students/services/charging-stations/)*

<sup>104</sup> *UCISA (2014) Model Regulations for the use of institutional IT facilities and systems: [www.ucisa.ac.uk/modelregs](http://www.ucisa.ac.uk/modelregs)*

Another effective approach is the use of virtual desktop technology which means that staff and student users have access to their personal and shared drives and the same set of software on any device whether this is on campus, at home or on a mobile device.

## Network issues

As more and more facilities go digital there are increasing demands on the network. Digital signage is increasingly used to help students navigate the campus, help students to see where seats in learning spaces are available in different areas and to broadcast real time information. These screens need access to the network so you need to ensure there are enough network access points.

Within a typical AV cabinet, there is frequently a requirement for perhaps six to ten individual network connections – much of the control communication between devices that was previously handled by RS232<sup>105</sup> or proprietary signalling is now commonly delivered over IP (internet protocol). Provisioning these services over IP also presents significant operational benefits, allowing remote monitoring, support and diagnostics.

It is not uncommon to deliver services of this type by deploying a small network switch within the AV cabinet, with a single uplink. A typical model may also involve deployment of an AV VLAN<sup>106</sup> to logically isolate this type of traffic from the general building traffic. Adopting this model requires close collaboration and a clear division of responsibility between the network and AV teams. Typically, the AV team might have responsibility for the deployment of the equipment, with networking colleagues overseeing the configuration.

Institutions may want to think about implementing channel bonding. Channel bonding<sup>107</sup> is a computer networking arrangement, in which two or more network interfaces on a host computer are combined for redundancy or increased throughput. Channel bonding is different from load balancing in that load balancing divides traffic between network interfaces on per network socket basis, while channel bonding implies a division of traffic between physical interfaces at a lower level, either per packet or on a data link basis.

There also needs to be close collaboration between the AV and networking teams and any third party installation contractor to ensure that the installation is deployed in accordance with the requirements of the wider network.

Conversely the degree of convergence between IT and audio visual technologies can cause confusion for non specialists. We heard of a number of examples where mechanical and engineering consultants have looked at the need for a ceiling projector and seen that, whereas previously there were separate AV cables, this data is now digitally encoded and run along category cable. They therefore specified a network point next to the projector and standard network cable running back to the nearest switch room. (AV is however using a point to point standard from the AV equipment at the front of the room. Although it happens to use similar cabling it is nothing to do with the network, and so a network point is not required).

## Telephones

An often overlooked aspect is the provision of telephony in teaching rooms. A telephony service, either conventional handsets or a communications tool built into the IT system, allows remote support services to be accessed should the lecturer encounter difficulties with technology, or to summon security or first aid should there be an incident.

Some universities programme their phones so calls from lecture halls and other learning spaces go straight to second line support, rather than being triaged. You can set hot dial keys (security, AV/ IT support, the departmental office) to make it easier for staff.

## Knowledge is power?

The provision of power is one of the topics that can polarise the views of stakeholders in learning space projects. We know that students always seem to want more power supplies but the attitude of those who are responsible for student support can sometimes be at odds with that of those stakeholders who are responsible for the university's carbon footprint or indeed for paying the electricity bill.

<sup>105</sup> <https://en.wikipedia.org/wiki/RS-232>

<sup>106</sup> [https://en.wikipedia.org/wiki/Virtual\\_LAN](https://en.wikipedia.org/wiki/Virtual_LAN)

<sup>107</sup> [https://en.wikipedia.org/wiki/Channel\\_bonding](https://en.wikipedia.org/wiki/Channel_bonding)

We have encountered very different approaches to the provision of power in large lecture theatres including: providing power to every seat; providing power to a percentage of seats; and only providing power to the first two rows to encourage students to sit near the front.

One thing all of the Toolkit contributors seem to agree on is that floor boxes are seldom a good idea and certainly not for high footfall areas. Perimeter power, on the other hand, will inevitably have students flocking to the sides of a room. Power furniture that integrates power supplies into seating and desks remains expensive and limits the flexibility of the space.

Similar issues arise in spaces that are used for meetings, events and conferences where delegates are at least as power hungry as students.

The provision of powered USB sockets integrated into desks or furniture, in addition to or instead of 13A mains outlets, is becoming more common. Wireless charging of smartphones via furniture<sup>108</sup> is also fast becoming a reality with areas such as airports and restaurant chains installing such facilities, but there are currently competing and incompatible standards<sup>109</sup>.



*“An issue that has cropped up a lot especially during assessment time in the library is ‘socket rage’. Students usually have about three devices each and we often aren’t doing enough to support their use. If learning resources are really virtual then we ought to be looking at access everywhere.”* Toolkit contributor



*“Power is the thing we never get right as we always think technology is going to overtake us and sort it out.”* Tessa Rogowski

## Resources

- The Oxford Brookes University approach to planning, purchasing and installing IT and AV equipment for the new John Henry Brookes teaching and learning building was an entrant for the 2014 UCISA Award for Excellence<sup>110</sup>.
- Imperial College has some standards on cabling. These are campus wide standards rather than specific requirements for learning spaces, but we present this as an example of standards being available to colleagues across the whole institution and suppliers<sup>111</sup>.
- Loughborough University has a useful case study on deploying external wifi on a campus based network<sup>112</sup>.

## On the horizon

We have not covered the ways in which technology may be employed to create smart buildings (for instance to manage energy consumption) but there are aspects of such developments that may impact on learning and teaching. One example, currently little used in UK higher education, is beacon technology. Beacons (often known as iBeacons after the Apple brand device) are small sensors that react to devices and apps in their vicinity. They are used in retailing to detect the location of customer smartphones in a store and push relevant advertising to the customer. However, they can have application in the delivery of learning content and are also of relevance in the field of learning analytics<sup>113</sup>, where attendance<sup>114</sup> and use of institutional facilities are seen to be potential indicators of student achievement. They may also be of use in the evaluation of learning space usage patterns.

<sup>108</sup> BBC News, *Ikea unveils phone-charging furniture at MWC (2015)*: <http://www.bbc.co.uk/news/technology-31693088>

<sup>109</sup> [www.makeuseof.com/tag/what-you-need-to-know-about-wireless-charging/](http://www.makeuseof.com/tag/what-you-need-to-know-about-wireless-charging/)

<sup>110</sup> [www.ucisa.ac.uk/~media/Files/members/awards/excellence/2014/OxfordBrookes.ashx](http://www.ucisa.ac.uk/~media/Files/members/awards/excellence/2014/OxfordBrookes.ashx)

<sup>111</sup> [www.imperial.ac.uk/admin-services/ict/self-service/connect-communicate/wifi-and-networks/network-infrastructure/](http://www.imperial.ac.uk/admin-services/ict/self-service/connect-communicate/wifi-and-networks/network-infrastructure/). See Appendix F - UTP cabling: [www.imperial.ac.uk/media/imperial-college/administration-and-support-services/ict/public/V1.3-appendix-F-UTP-cabling.pdf](http://www.imperial.ac.uk/media/imperial-college/administration-and-support-services/ict/public/V1.3-appendix-F-UTP-cabling.pdf)

<sup>112</sup> <https://community.jisc.ac.uk/library/advisory-services/deploying-external-wi-fi-campus-based-network>

<sup>113</sup> <http://www.laceproject.eu/faqs/learning-analytics/>

<sup>114</sup> The University of Bradford use iBeacons. The project Bradford undertook to implement iBeacons was commended in the 2015 Amber Miro Memorial Award: [www.ucisa.ac.uk/bestpractice/awards/amma/2015](http://www.ucisa.ac.uk/bestpractice/awards/amma/2015). A short video showcases the project: [www.youtube.com/watch?v=H2YMPGqfzqs&feature=youtu.be](http://www.youtube.com/watch?v=H2YMPGqfzqs&feature=youtu.be)

## 5 Learning technologies



### THIS SECTION AT A GLANCE

- we explore the types of technology used in physical learning spaces;
- we identify that both high-tech and low-tech solutions can aid collaborative working;
- we look at some case studies of innovative use of technology in physical space.

### Expectations from reading this section

In the context of learning spaces there may be some ambiguity as to what actually constitutes a *learning technology* as opposed to more generic audio visual tools. In this section we take a very broad view of the use of technology to support learning and discuss most of the equipment used in physical learning spaces. If you are looking for specific guidance on visual displays in terms of size, and viewing angles then you will find this in the visual standards subsection within Section 4, Effective learning by design.

We aim to give a broad overview of the main technologies in use and explore some relatively innovative tools in order to inspire readers to try a range of different approaches.

In particular we suggest that:

- whilst teaching in lecture theatres continues to be an important feature of higher education, technology has changed the types of learning activity that take place in these physical spaces;
- BYOD is a game changer in terms of the types of interactivity that are now possible in large cohorts;
- inclusivity still represents a challenge for some technology enhanced learning.

### 5.1 Rethinking practice with technology

The continued importance of physical learning spaces lies in their being able to support learning activities that could not happen in other ways and technology has an important role to play in this. If we view the format of the traditional lecture as stemming from a scarcity of information sources (the fact that learners had to be physically present to hear from the expert, and the only person who had access to books) then the current abundance of information sources means that access to information is no longer a primary reason for bringing people together, and we need to rethink the types of learning students undertake in these collective situations.

The traditional lecture may be the most obvious example where we need to rethink pedagogy but there are many other situations where technology can help create more effective learning experiences.

There is of course more to this than simply providing technology. We need to ensure that the technologies are appropriate for the types of learning going on in the space; that the user interfaces are simple and intuitive and that lecturers are supported in making effective use of the technology. A number of contributors to this Toolkit reported that some of the technology available in their institutions was underutilised. When we asked why this was the case one answer summed up the issues for many: “This has to do with tradition, familiarity and some academics thinking it is still 1985”. It is equally to do with a lack of appropriate staff development and showing people the potential and opportunities. When this happens, many experience a “eureka” moment!

## 5.2 Examples of technologies used in physical learning spaces

### 5.2.1 Lecture capture systems

The term lecture capture covers a range of technologies that creates a digital record of what happens in a lecture or class. The simplest form of lecture capture might be an audio recording that can be made available as an MP3 file for students to play back on portable devices. At the other end of the spectrum some universities have a dedicated studio where tutors can record classes for use in online learning contexts (including MOOCs<sup>116</sup>) or blended learning<sup>117</sup>.

In this Toolkit we are looking mainly at systems that are used in a typical lecture theatre such as the brands Echo360<sup>118</sup>, Panopto<sup>119</sup> and the open source solution Matterhorn<sup>120</sup>.

The types of functionality such systems provide typically include:

- administrative tools for scheduling automated recordings, manually uploading files, and managing videos, metadata, workflows and processing functions;
- integration with recording devices in the classroom for managing automated capture of audio, VGA, and multiple video sources;
- processing and encoding services that prepare and package the media files according to configurable specifications;
- distribution to local streaming and download servers and configuration capability for distribution to channels such as YouTube;

<sup>115</sup> [www.psy.gla.ac.uk/~steve/evs/il.html](http://www.psy.gla.ac.uk/~steve/evs/il.html)

<sup>116</sup> [https://en.wikipedia.org/wiki/Massive\\_open\\_online\\_course](https://en.wikipedia.org/wiki/Massive_open_online_course)

<sup>117</sup> [https://en.wikipedia.org/wiki/Blended\\_learning](https://en.wikipedia.org/wiki/Blended_learning)

<sup>118</sup> <http://echo360.com/>

<sup>119</sup> <http://panopto.com/>

<sup>120</sup> [www.opencast.org/matterhorn](http://www.opencast.org/matterhorn)



*“In fact it is not enough to be different: it should be better than the alternatives. Learners are routinely much more interactive with the material when using books (or handouts) than they can be with lectures: they read at their own pace, re-read anything they can’t understand, can see the spelling of peculiar names and terms, ask other students what a piece means, and carry on until they understand it rather than until a fixed time has passed. All of these ordinary interactive and active learning actions are impossible or strongly discouraged in lectures.*

*So for a lecture to be interactive in a worthwhile sense, what occurs must depend on the actions of the participants (not merely on a fixed agenda), and benefit learning in ways not achieved by, say, reading a comparable textbook.” (Dr Steve Draper, University of Glasgow<sup>115</sup>)*



Photo 10: Quick access terminals in corridor spaces at Newcastle University.

- user interface for learners to engage with content, including slide preview, content based search etc.

A similar type of technology, not covered here, is software such as Camtasia<sup>121</sup> that captures on screen activity such as typing and cursor movements thus allowing the tutor to create an online demonstration with an audio voiceover. The key difference is that standalone software such as this is not integrated with the virtual learning environment (VLE) or scheduling systems and therefore requires significantly more user effort to make a recording available.

Lecture capture offers a number of benefits for students:

- the opportunity to review aspects of the class they found difficult to understand;
- provides a study aid for review and revision;
- helps accommodate different learning styles;
- assists students who have particular educational needs;
- support for students with dyslexia or who do not have English as their first language;
- where video is used this can be useful in reviewing complex formulae written on a board, props used by the presenter or the steps of a demonstrated procedure.



Photo 11: AV pods in the interactive lecture theatres at City University are equipped with a range of learning technologies including: visualiser, interactive pen and digital flipchart.

To some extent lecture capture formalises something that students will do for themselves if they see a need as it is easy to make poor quality recordings using mobile devices. In the early days of lecture capture there was considerable concern that students would simply stop attending lectures (similar concerns in fact to those raised when tutors started putting lecture notes on VLEs). Our discussion on the concept of interactive lectures and what kind of learning experience the lecture should provide if it is to remain a viable learning activity in the 21st century is of relevance here. It is also the case that watching or listening to a recording does not really take any less time than attending the lecture in person.

Not all lecturers are comfortable about being recorded, particularly on video. The choice of which elements of the lecture to record depends both on the tutor's preference and what is actually being presented e.g. for complex formulae written on a board or for scientific demonstrations the use of video is essential whereas for many other types of lecture, a view of the slides with audio voiceover may give a better quality output. A clear policy is required to support such technology, and this can require a change in institutional mind sets. Loughborough University has a policy for lecture capture<sup>122</sup>.

The introduction of such technologies represents an interesting exercise in change management. A pilot study<sup>123</sup> by the University of Edinburgh in 2008/09 produced some interesting results in relation to perception:

- academic staff who were not involved gave lecture capture -5% approval;
- academic staff who were involved gave it +56% approval;
- students gave lecture capture +87% approval;
- 69% of lecturers involved would like to have their lectures recorded again.

Lecture capture makes possible interesting new developments such as the concept of the *flipped classroom* whereby a tutor makes the lecture recording available for students to view in advance so that the class time can be used in interactive discussion about material with which students should already be familiar.

121 [www.techsmith.com/camtasia.html](http://www.techsmith.com/camtasia.html)

122 Loughborough University Lecture Capture Policy (2015): [www.lboro.ac.uk/media/www/lboroacuk/content/teachingsupport/downloads/Loughborough%20University%20Lecture%20Capture%20Policy%20Jan%202015.pdf](http://www.lboro.ac.uk/media/www/lboroacuk/content/teachingsupport/downloads/Loughborough%20University%20Lecture%20Capture%20Policy%20Jan%202015.pdf)

123 [www.ed.ac.uk/information-services/computing/audio-visual-multi-media/captured/background](http://www.ed.ac.uk/information-services/computing/audio-visual-multi-media/captured/background)

A complication for UK universities is that there is no standard approach to the attribution of lecture content as intellectual property. Some universities view materials produced by lecturers in the course of their employment as the university's intellectual property whereas in other cases ownership resides with the individual lecturer. In either case performing rights may remain with the lecturer so there is a need to establish clear policies on the capture and release of teaching sessions. It is of course also the case that lecture capture serves as a useful reminder to lecturers to ensure they have appropriate copyright clearance on all the materials they use in the lecture.

Newcastle University is unusual in having an opt out policy rather than an opt in policy when it comes to lecture capture<sup>124</sup>. Loughborough University “strongly encourages the recording of lectures with ReVIEW in undergraduate and postgraduate teaching, for the benefit of both campus-based students and distance learners”, although recognises that it is not appropriate in all contexts or disciplines.

The University of Derby has tended to emphasise principles rather than a specific policy. The University owns the lecture content but the academic owns the publishing so there is no pressure to put up a lecture if they feel they have had a bad day. Lecturers are also in charge of *takedown* which gives them a sense of ownership. Copyright and IPR are specifically covered in staff development.

Lecture capture is not suitable in all situations (such as group work). Some lecturers remember to turn off the recording when the group work starts but they forget to switch it back on again when they start to speak again.

The existence of significant archives of recorded lectures in turn generates a need for ways of making this information readily usable by students such as the ability to bookmark and annotate sections of lectures. One technology that can help with this is Synote<sup>125</sup> produced by the University of Southampton and available as an open source product. Synote is a web based application that permits the creation of synchronised bookmarks or *Synmarks* that can contain notes and tags synchronised with audio or video recordings, transcripts and slides/images and can be used to find and replay parts of the recordings.

### 5.2.2 Electronic voting systems (EVs)

Electronic voting systems (EVs), also known as personal response systems (PRSs) or clickers, are a classroom based technology which can be used to support learning, teaching and assessment. The technology comprises of a handset, receiver and software to enable the creation of question slides. Commonly the software is available as a PowerPoint add in so that lecturers can use an EVs within a context where they are comfortable. Questions are written in the format of choice e.g. multiple choice, Likert scale or true/false statements and are delivered as part of a classroom based session with as many or as few questions as desired. The lecturer controls the pace of the session and the display of results.

Students can use special handsets, or increasingly their own mobile devices, to give their responses when the polling option is open. Systems such as Turning Point ResponseWare<sup>126</sup> allow an existing investment in hardware handsets to be blended with use of a mobile app or website session on student devices.

EVs can be used to support a multitude of teaching strategies including:

- simple questions to check understanding and give formative feedback to both students and presenter;
- using responses (e.g. proportion who got it right) to switch what you do next: *contingent teaching* that is adapted on the spot to the group;
- brain teasers to initiate discussion (because generating arguments (for and against alternative answers) is a powerful promoter of learning);
- mediating debates;
- facilitating peer assessment.

Benefits for students include the ability to participate but remain anonymous. This is particularly useful for those students who are less confident, articulate or language-proficient than their peers. It ensures the whole class has an opportunity to engage in learning activities as well as promoting two way interaction between lecturer and student.

<sup>124</sup> Newcastle University ReCap Policy 2015-16 (2012): <https://teaching.ncl.ac.uk/recap/servicepolicy/recappolicy/>

<sup>125</sup> [www.synote.org/synote/](http://www.synote.org/synote/)

<sup>126</sup> [www.turningtechnologies.com/response-solutions/responseware](http://www.turningtechnologies.com/response-solutions/responseware)

The other important advantage for students is the speed at which feedback can be delivered for questions with right and wrong answers. This tells students exactly what they are doing well and where they need to revise. The immediacy of the feedback also gives teachers valuable information about class performance enabling them to adjust the session content according to the responses given.

To date EVS has required considerable time and effort to be expended on the supporting infrastructure. The University of Hertfordshire has made widespread use of EVSs<sup>127</sup> which required the following:

- EVS receivers in place in teaching rooms;
- software loaded onto computers in teaching rooms;
- EVS handsets issued to cohorts of students;
- EVS database on which all handsets issued to students are registered along with the name of the student;
- EVS receiver channel sign in every classroom to ensure staff and students know what number the system is operating on;
- cross-campus channel mapping exercise to minimise channel conflict between classrooms (a significant problem in the early days);
- occasional software upgrades;
- centralised processes for procurement, handset registration, user support and for ensuring classroom readiness were all key to embedding the technology at an institutional level.

Experience at the University of Hertfordshire showed that the promptness of feedback is probably the most useful feature for both teachers and students.

However, they also experienced difficulties with the technology including channel conflicts, battery failure and user error (the latter being the most common). Because of these issues the use of EVS technology in summative assessments had certain drawbacks namely:

- an inherent risk of system failure at individual and cohort level;
- causes unnecessary tension and/or anxiety for all concerned;
- can pose significant problems in terms of inclusivity.

Due to these drawbacks the university has shifted away from using this technology in summative assessment, although it continues to be used formatively.

Many other UK universities have made widespread use of EVSs, often adopting different models to manage and distribute the handsets. Two notable examples are the University of Surrey where handsets are borrowed by students, via self-issue, from the library for the duration of a semester, and University College London where a number of the larger lecture theatres have the handsets fixed in the seating positions.

EVS technology has been in use for a number of years now and is probably nearing the end of its life as a separate classroom technology due to the greater convenience of alternatives using a BYOD approach. Given ubiquitous wifi, large numbers of students having smartphones and tablets, and the availability of apps and web based polling, few universities are investing heavily in clickers. Mentimeter<sup>128</sup>, Socrative<sup>129</sup>, Poll Everywhere<sup>130</sup>, Kahoot!<sup>131</sup> and Participoll<sup>132</sup> are all apps that work across a range of devices.

127 Jeffries, A. (2011) *Introducing and Using Electronic Voting Systems in a Large Scale Project With Undergraduate Students: Reflecting on the Challenges and Successes*. University of Hertfordshire: <http://uhra.herts.ac.uk/handle/2299/7691>

128 [www.mentimeter.com/](http://www.mentimeter.com/)

129 [www.socrative.com/](http://www.socrative.com/)

130 [www.polleverywhere.com/](http://www.polleverywhere.com/)

131 <https://kahoot.it/>

132 [www.participoll.com/](http://www.participoll.com/)

### 5.2.3 Web conferencing

Web conferencing permits remote participation in lectures or seminars. A campus based session may be broadcast so that remote students can participate. Alternatively, the remote participant may be a guest expert speaker. Due to geographical considerations Welsh universities and the University of the Highlands and Islands have long made use of these type of facilities to bring in remote experts to teach on parts of courses.

Edinburgh Napier University is using WebEx<sup>133</sup> with overseas students in Hong Kong and is looking at bringing in *captains of industry* to give video lectures. The university emphasises the need to think about the use of technology in relation to building employability skills in students and WebEx is also one of the main systems used in the business world.

A number of Universities are using Big Blue Button<sup>134</sup> which is open source and can be integrated into a VLE. Other subscription services include Blackboard Collaborate<sup>135</sup> and Adobe Connect<sup>136</sup>.

### 5.2.4 Visualisers

Visualisers are effectively digital overhead projectors (OHPs). They allow people to use 3D objects instead of paper e.g. engineers demonstrating circuit boards. Anything under the visualiser can also be captured by lecture capture. When used with lecture capture there may be some issues with the video quality but the results are adequate bearing in mind that lecture capture is mainly intended for people who were in the room to refresh their knowledge and personal experience.

The University of Birmingham found that the technology was being underutilised and held a visualiser workshop to encourage science staff who do a lot of writing to adopt more inclusive practice (so that students can actually see and the outputs can be used in lecture capture).

At Loughborough University they were marketed as digital OHPs as academic staff felt more comfortable with the term rather than using *visualiser*. This aided the process of the withdrawal of OHPs within one week.

### 5.2.5 Wifi apps

There is growing demand for tools to facilitate wireless projection and collaboration between mobile devices. Tutors want to be able to being able to mirror their iPad and Android devices to the data projector, and apps such as Display Note<sup>137</sup> allow students to login through the app and share their screen with the lecturer who can then choose to broadcast it to other devices. Despite increasing interest in wifi apps there is no single technology that is widely adopted and some institutions have reported difficulties with wireless projection and mobile collaboration over eduroam wifi.

### 5.2.6 Interactive surfaces

A range of interactive surfaces are in use for teaching and learning purposes ranging from common end user devices such as smartphones, tablets and iPads to more specialist equipment.



Photo 12: Technology features heavily in the Learning Curve at the University of Derby.

© University of Derby

<sup>133</sup> [www.webex.co.uk/](http://www.webex.co.uk/)

<sup>134</sup> <http://bigbluebutton.org/>

<sup>135</sup> [www.blackboard.com/online-collaborative-learning/index.aspx](http://www.blackboard.com/online-collaborative-learning/index.aspx)

<sup>136</sup> [www.adobe.com/in/products/adobeconnect.html](http://www.adobe.com/in/products/adobeconnect.html)

<sup>137</sup> <http://displaynote.com/>

**Interactive whiteboards** —are digital screens that connect to projectors and computers. The screen acts as a touchscreen and anything displayed on the board can be saved in digital format. SMART Technologies<sup>138</sup> is a major supplier of interactive whiteboards so they are often referred to as SMARTboards. There is often a big gap in expectations between students who have come from schools where interactive whiteboards are the norm and lecturers who do not know how to use them. They are also difficult to scale up in large lecture theatres. Many universities are moving away from their use except in education subjects where they serve to replicate the school classroom set up.

**Multi-touch tables (MTT)** —are now commercially available and we are beginning to see their use in learning spaces<sup>139</sup>. As far as we are aware the first MTT developed as a direct result of learning space activities was by the Active Learning in Computing (ALiC) Centre for Excellence in Teaching and Learning (CETL) at Durham University<sup>140</sup>. The CETL focused on problem based learning activities and developed a Techno-Café<sup>141</sup> with high tech booths designed to support students collaborating around a single computer screen. The experiment was highly successful but, even though the technology greatly facilitated collaboration, some interesting observations were made. Even in spaces such as this, it was possible for one student to dominate by taking control of the keyboard, tablet PC or interactive pen. A similar phenomenon was noted at the University of Middlesex<sup>142</sup>. The nature of the technology posed a barrier to equal collaboration so research focused on the use of multi-touch devices to offer equal opportunity for all to collaborate.

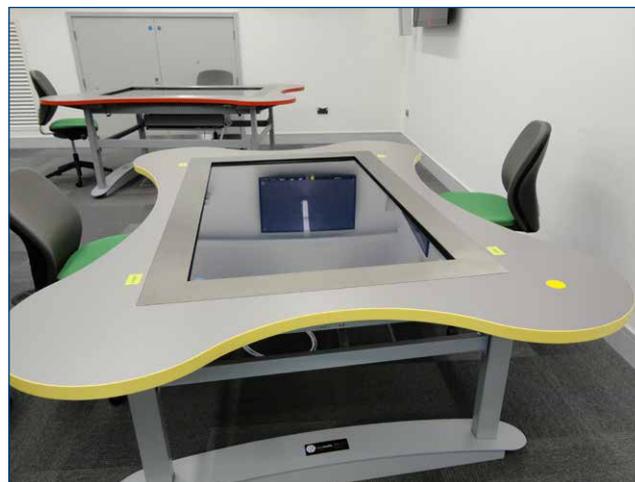


Photo 13: Multi-touch butterfly tables in use at the University of Exeter.

CC BY-NC-ND 2.0 JiscInfoNet

The Durham researchers attempted to address the problem by creating a situation where the table itself could act as the interactive display. They effectively invented a giant iPad - in the form of a multi-touch table for up to four users - well before the Apple device was in production. In the period 2009-2013 they undertook extensive research into how students learned using these devices. The work was shortlisted for a prestigious World Technology Award in 2012<sup>143</sup>. Largely as a result of this work, multi-touch tables are now commercially available although bespoke designs may be required to ensure the surfaces are sufficiently robust for use by large numbers of students. The University of Exeter Exploration Lab<sup>144</sup>, which opened in 2012, has ten multi-touch butterfly tables. The tables allow up to four users to log on to their own file space in active directory and to share files with other tables. Each table is also connected to a wall mounted display screen to support peer review.

## 5.2.7 Augmented reality

Augmented reality (AR) integrates digital information with the physical environment in real time by superimposing a computer generated image on a user's view of the real world to provide a composite view. Its uses are currently best known in areas such as enhancing information about tourist attractions but educational use is increasing. Examples include the University of Manchester using AR to enhance the study of medieval manuscripts, landmark editions and modern literary archives<sup>145</sup>; City University using AR in the School of Health Sciences<sup>146</sup> and the University of Exeter using AR to create an information layer for its entire campus<sup>147</sup>.

138 <http://home.smarttech.com/>

139 Multi-touch tables: interactive surfaces built into a table to support collaboration by multiple users.

140 [www.dur.ac.uk/news/newsitem/?itemno=6969](http://www.dur.ac.uk/news/newsitem/?itemno=6969)

141 [www.dur.ac.uk/alice/technocafe/](http://www.dur.ac.uk/alice/technocafe/)

142 <http://jiscdesignstudio.pbworks.com/w/page/24184002/ISCC%20Project>

143 [www.dur.ac.uk/news/newsitem/?itemno=15642](http://www.dur.ac.uk/news/newsitem/?itemno=15642)

144 <https://as.exeter.ac.uk/it/openaccess/exetertable/>

145 Special Collections using Augmented Reality to Enhance Learning and Teaching (SCARLET): [www.webarchive.org.uk/wayback/archive/20140614081239/http://www.jisc.ac.uk/whatwedo/programmes/elearning/litig/scarlet.aspx](http://www.webarchive.org.uk/wayback/archive/20140614081239/http://www.jisc.ac.uk/whatwedo/programmes/elearning/litig/scarlet.aspx)

146 <https://blogs.city.ac.uk/care/about/>

147 [www.exeter.ac.uk/students/life/layar/](http://www.exeter.ac.uk/students/life/layar/)

## 5.2.8 Writing technologies

We could perhaps have subtitled this section *low-tech technologies* as some of the equipment that best supports collaboration in learning spaces does not have to include a digital component. Writable surfaces in learning spaces are highly conducive to collaboration, participation and active learning. Students often take photos of these outputs and share them via their phone so something that starts in analogue turns into digital.

The Robinson Rooms at The London School of Economics (LSE)<sup>148</sup> were designed to support increased emphasis on group work and research. Magnetic work walls and magnetic paint on structural features were used to create instant opportunities to share and exhibit thought processes. The magnetic work walls can be used as group screens and also work surfaces.

Many universities are now using glass writing boards to create writable walls. The writable glass can be used as dividing partitions in small group learning spaces. At City University<sup>149</sup> the glass is used in breakout areas for the interactive lecture theatres and is often used in conjunction with digital technology to annotate an image projected onto the glass. Glass writing boards can also have drawbacks in learning spaces because they are prone to glare and reflections, especially when students try to photograph the content on the boards. They can also be challenging to integrate with lecture capture solutions as the content on the board is often as important, if not more so, than the digital presentation.

In addition to glass writing boards, many new spaces are being created with glass walls dissolving the inside/outside space and allowing staff and students to see what is happening both in a formal and informal setting. These glass walls are a good writing surface and staff and students should have permission to utilise this additional facility.

More traditional writing surfaces remain useful even in the digital age. Column boards can be custom made and fitted with electric motors to provide a suitable writing surface for the largest lecture theatres. Rail systems allow horizontal sliding of writing surfaces and the combination of flipcharts, writing boards, projection surfaces and pin boards in smaller classrooms. Roller boards can be wall mounted or floor standing.



© University of Derby

Photo 14: Glass writing walls are widely used at the University of Derby.



**“Write-on and moveable walls** – There are 16 floor-to-ceiling, 1.2 metre wide white panels that move easily on an overhead track and can be locked in place when in position. These can transform the open space to create a series of working areas, projection booths, exhibition spaces etc. Groups can work in their own area using the write-on-walls to visualise their thinking and then push them into position for a presentation to the larger group. Though expensive (approx £1,000 each) these walls have arguably been the most popular and educationally successful elements in the space.” (Martin 2010<sup>150</sup>)



“... the technology provision was used to a far lesser degree than expected. When used well it had the capacity to be a powerful support for learning and the creative process, but on the whole, its operation seemed to require more time and trust than most tutors were prepared to invest in, and the most popular use of the technology was the off button.” (Martin 2010<sup>151</sup>)

148 <https://jiscinfonetcasestudies.pbworks.com/w/page/45468872/London%20School%20of%20Economics%20-%20Robinson%20Rooms>

149 <https://blogs.city.ac.uk/educationalvignettes/2013/03/09/squiggle-glass/#.VeWXzzYVhHa>

150 Martin, P. (ed) 2010) *Making space for creativity*. University of Brighton: [http://about.brighton.ac.uk/creativity/Library/UofB\\_msfc-ebook\\_FINAL.pdf](http://about.brighton.ac.uk/creativity/Library/UofB_msfc-ebook_FINAL.pdf)

151 Martin, P. (ed) 2010) *Making space for creativity*. University of Brighton: [http://about.brighton.ac.uk/creativity/Library/UofB\\_msfc-ebook\\_FINAL.pdf](http://about.brighton.ac.uk/creativity/Library/UofB_msfc-ebook_FINAL.pdf)



## VIEWPOINT

**Paul Burt, Learning Spaces Service Owner, University College London (UCL)**, recognises the diversity of disciplinary needs when it comes to technologies to support learning and teaching. He told us *“There are some departments that don’t turn on the E facilities at all: all they want are good writing surfaces”*.

Paul takes a very pragmatic view to making learning technologies as simple and usable as possible because lecturers simply do not have the time to learn how to use a piece of equipment or software. He contrasts higher education with the school environment where a teacher has their own classroom and hence it is worth them investing the time to learn how to use facilities such as an interactive whiteboard that might be provided in the classroom. At UCL Paul is supporting lecturers who might have to teach in any one of 300 different rooms.

Paul maintains that capturing writing will continue to be important for many years to come and he feels there is still an untapped market for products that can capture and digitise a large area of written material as opposed to those that can handle tiny areas in great detail.

UCL has all of its classroom services supported by a single team so AV support is not distinct from IT support. Paul however recognises the importance of specialist AV skills and points out that the trend towards AV and IT convergence has caused problems for many universities. The idea that a general IT person should be able to take on all kinds of AV support underestimates the specialist skills needed as well as the cost to institutions of lost teaching time through technical failure. Paul believes that the static nature of classroom design over a long period of time has contributed to AV being seen as a reactive support role not involved in new developments or having a voice in strategic discussions. Paul can see that it would be equally possible to take a much narrower view of the IT role and say *“If it doesn’t have a plug on it then it isn’t to do with us”*, but that is not how he views things. Paul prefers to take a holistic view and knows that his job is to ensure the student experience is right in the end.

## Resources

- Edinburgh Napier University case study on their use of online collaboration tools<sup>152</sup>.
- The University of Hertfordshire undertook a thorough evaluation of its experience with electronic voting systems in 2012<sup>153</sup>.
- University College London video on electronic voting systems<sup>154</sup>.
- The University of Glasgow interactive lectures website has some good advice on designing questions<sup>155</sup>.
- University College London has an extensive resource centre dealing with all aspects of lecture capture<sup>156</sup>.
- University College London videos of staff and student perspectives on lecture capture<sup>157</sup>.
- This publication by the UK Media-Enhanced Learning Special Interest Group (MELSIG) looks at innovative practice in teaching and learning with smartphones and tablets<sup>158</sup>.
- City University has produced some Top Tips for creating augmented reality resources in education<sup>159</sup>.
- University of Sussex guide to using interactive whiteboards<sup>160</sup>.

152 [www.cisco.com/c/dam/en/us/products/collateral/conferencing/webex-meeting-center/edinburgh-napier-university.pdf](http://www.cisco.com/c/dam/en/us/products/collateral/conferencing/webex-meeting-center/edinburgh-napier-university.pdf)

153 <http://jiscdesignstudio.pbworks.com/w/file/fetch/60025852/EEVFinalReport%20reportNewFrontpage.pdf>

154 [www.ucl.ac.uk/teaching-learning/technology/voting-systems](http://www.ucl.ac.uk/teaching-learning/technology/voting-systems)

155 [www.psy.gla.ac.uk/~steve/evs/qpurpose.html](http://www.psy.gla.ac.uk/~steve/evs/qpurpose.html)

156 <https://wiki.ucl.ac.uk/display/LecturecastResourceCentre/Home>

157 [www.ucl.ac.uk/teaching-learning/technology/lecturecast](http://www.ucl.ac.uk/teaching-learning/technology/lecturecast)

158 Middleton, A., ed. (2015). *Smart learning: Teaching and learning with smartphones and tablets in post compulsory education. Media-Enhanced Learning Special Interest Group and Sheffield Hallam University*: [http://melsig.shu.ac.uk/?page\\_id=503](http://melsig.shu.ac.uk/?page_id=503)

159 <https://blogs.city.ac.uk/care/>

160 [www.sussex.ac.uk/tel/learningtechnologies/iwb](http://www.sussex.ac.uk/tel/learningtechnologies/iwb)

## 6 Evaluation



### THIS SECTION AT A GLANCE

- we look at the need for evaluation of learning space projects including the real purpose behind the evaluation – what it is we are actually trying to measure;
- we look at a range of approaches to learning space evaluation.

### Expectations from reading this section

Estates professionals may already be familiar with the concept of post-occupancy evaluation of a physical space but may have less experience in designing evaluations that measure the success of space as effective *learning* space. Similarly, professionals that directly support learning and teaching activities, may measure aspects of user behaviour without relating them in any way to the physical space. It is to be expected that from reading this section those charged with delivering learning spaces will appreciate the need for a cross functional approach to determining what success looks like and will plan early in the life of a project what needs to be evaluated and how this should be done.

In particular we suggest that:

- Evaluation is an integral part of any learning space development and should be considered from the outset of any project.
- We need to be able to evaluate the *learning* taking place as well as more readily quantifiable measures of usage of the space and technology.
- We need to develop measures of success that relate to the activities and behaviours of students and how they communicate and collaborate within the space.
- We need to use a range of qualitative and quantitative evaluation methods.
- We need to ensure the involvement of a wide range of stakeholders including learners.

### 6.1 Typical post-occupancy evaluation (POE)

Post-occupancy evaluation (POE)<sup>161</sup> is well established within the higher education estates management function and AUDE has collaborated on producing guidance published by HEFCE (2006) on the topic<sup>162</sup>.

<sup>161</sup> POE - post occupancy evaluation - the standard term for the techniques used to assess the outcomes of a construction project.

<sup>162</sup> HEFCE (2006) Guide to Post Occupancy Evaluation: [www.smg.ac.uk/documents/POEBrochureFinal06.pdf](http://www.smg.ac.uk/documents/POEBrochureFinal06.pdf)

In that guidance POE is used as an umbrella term that includes a review of the process of delivering the project as well as a review of the technical and functional performance of the building during occupation. POE is a way of providing feedback throughout a building's lifecycle from initial concept through to occupation. The information from feedback can be used for informing future projects, whether it is on the process of delivery or technical performance of the building. It serves several purposes:

### ***Short term benefits of POE***

- identification of and finding solutions to problems in buildings;
- response to user needs;
- improve space utilisation based on feedback from use;
- understanding of implications on buildings of change, whether it is budget cuts or working context;
- informed decision making.

### ***Medium term benefits of POE***

- built-in capacity for building adaptation to organisational change and growth;
- finding new uses for buildings;
- accountability for building performance by designers.

### ***Longer term benefits of POE***

- long term improvements in building performance;
- improvement in design quality;
- strategic review.

## **6.2 What are we evaluating in a learning space and why?**

Typical POE, as outlined above, serves an essential function in relation to construction projects and estates management but this section is written with the premise that in designing a new learning space we are aiming to enhance *learning*. That may seem obvious but a standard POE can go into great detail about various functional and technical issues without addressing the fundamental question of whether the space makes a difference to learning. In this regard we are explicitly using the term learning as distinct from whether the space has had an impact on *teaching* practice as, again, the two are not the same thing. They are of course related and change in practice may be expected to lead to change in outcomes. Pragmatically, it may be the teaching you can observe and evaluate in the short term. Overall, however we should be looking to measure benefits realisation against the broader project goals.



*“The danger is that we use the old measures to measure new space and thereby find it wanting.”*  
Toolkit contributor



*“I have had some negative experiences of POE being just a box ticking exercise. People often just want to get it over with to get the project signed off and qualitative and important stuff gets overlooked.”* Toolkit contributor

UK higher education institutions do not have a strong tradition of carrying out such evaluations. Aside from data collection on numbers of users and their activities in libraries and learning resource centres:

*“consideration of space in higher education has commonly taken place either in the context of space planning, or as part of campus master-planning and architecture, rather than being seen as a resource to be managed as an integral part of teaching and learning, and research, activities” (Temple 2008)<sup>163</sup>.*

One of the reasons for this is related to the inherent difficulty of such an undertaking. A 2009 study for Jisc of how learning spaces were being evaluated identified:

*“The evaluation of learning is fraught with difficulty, if nothing else because there are many conceptions of what constitutes learning and how the process occurs. There is widespread agreement that current assessment methods do not fully evaluate learning, but little consensus as to how they might be augmented or replaced to do so. Thus, Learning Space evaluations often owe more to Space evaluation more generally, with processes of learning and teaching often being evaluated only in a modest sense, if at all” (Pearshouse et al 2009)<sup>164</sup>.*

If we accept that learning space projects are change projects then there needs to be careful consideration of how we can measure the success of such space. Research on the topic such as Watson *et al* (2007)<sup>165</sup> and Pearshouse *et al* (2009)<sup>166</sup> recommends a range of measures including:

- greater use of baselining so that we have pre-and post-evaluations;
- greater involvement of teaching and support staff;
- use of behavioural observation and tools such as social network analysis.

Roberts and Weaver (2006)<sup>167</sup> have suggested that learning space evaluation should help us meet the following needs:

- to gain first hand knowledge of student learning needs;
- to capture how the learning environment features in the student lifecycle in order to link evaluation outcomes more readily to student achievements, progression and learning outcomes;
- to analyse how best to use ICT and record novelty in real life settings;
- to define what adds value and what is valued by the institution and individual/teams;
- to reach a common understanding on the use of language around evaluation;
- to ensure that there is evidence to support the institutional return on investment by providing tangible evidence as justification for continuing investment;
- to feed into future planning – evaluation must be an iterative process and undertaken early on before the project is implemented;
- to connect project outcomes to the context of the university and what it is trying to achieve, ensuring fit between evaluation approaches and required benchmarks;
- to demonstrate the benefits to the institution and the learning community, and maximise them during ongoing change.

163 Temple, P. (2008) Learning Spaces in Higher Education: An Under-Researched Topic. *London Review of Education*, vol. 6, no. 3, pp. 229–241.

164 Pearshouse, I., Bligh, B., Brown, E., Lewthwaite, S., Graber, R., Hartnell-Young, E. and Sharples, M. (2009) *A Study of Effective Evaluation Models and Practices for Technology Supported Physical Learning Spaces*. Report produced for Jisc: <http://oro.open.ac.uk/29996/2/>

165 Watson, L., Anderson, H. and Strachan, K. (2007) *The Design and Management of Open Plan Technology Rich Learning and Teaching Spaces in Further and Higher Education in the UK*. Report produced for Jisc: [www.webarchive.org.uk/wayback/archive/20080925103236/http://www.jisc.ac.uk/whatwedo/themes/elearning/tele/managinglearningspaces.aspx](http://www.webarchive.org.uk/wayback/archive/20080925103236/http://www.jisc.ac.uk/whatwedo/themes/elearning/tele/managinglearningspaces.aspx)

166 Pearshouse, I., Bligh, B., Brown, E., Lewthwaite, S., Graber, R., Hartnell-Young, E. and Sharples, M. (2009) *A Study of Effective Evaluation Models and Practices for Technology Supported Physical Learning Spaces*. Report produced for Jisc: <http://oro.open.ac.uk/29996/2/>

167 Roberts, S. and Weaver, M. (2006) *Spaces for learners and learning: evaluating the impact of technology-rich learning spaces*, *New Review of Academic Librarianship*, vol. 12, no. 2, pp. 95-107.

Technical evaluation of AV systems can sometimes be overlooked. Whilst universities and colleges are getting better at designing to recognised standards, we rarely evaluate the delivered solution against these. We also fail to repeat this evaluation on a regular basis over the life of the system, meaning our life cycles are based more on manufacturer guidance and compatibility than delivered functionality. Audio coverage, induction loop field strength, reflected light from projectors and screens all deserve greater attention. These technologies can be measured with remote management systems. Better use of automated reporting will help institutions to design for the next system (as well as developing the overall technology application) and in the longer term relevant data could be fed back to manufacturers.

### 6.3 What does success look like?

The Learning and Skills Council which (until its abolition in 2010) had responsibility for a college building programme in further education, suggested the following criteria<sup>168</sup> should be reflected in all new projects:

- **Innovation and Excellence** – is it an innovative and high quality new style of learning environment for the 21st century?
- **Adaptability** – can the design accommodate changing learning styles through flexible provision?
- **Manageability** – will it be easy to manage and make effective and efficient use of staff?
- **Accessibility** – is it an inclusive and accessible place for learning that supports engagement while providing a safe and secure environment, accessibility to learning systems, technology and resources?
- **Atmosphere** – does the design create a feel good factor for learners and staff?
- **Sustainability** – how effectively does the design consider climate change, sustainable materials, energy efficiency, transport, physical quality of the learning environment re: daylight, air, and acoustics?



*“The challenge from an evaluation perspective is to get the evidence that certain learning spaces achieve better results. This is very difficult to achieve as there are so many different variables.”*  
Caroline Pepper

### 6.4 Establishing a baseline

A baseline is a start point against which you can show that your project has delivered a tangible improvement. This may imply a measurable improvement in time, cost or quality but qualitative evidence that the experience of certain stakeholders has improved can be equally valid. By developing a baseline you ensure that you understand the current state of play before you try to change it.

The baseline is a component of your evaluation plan and is, to some extent, a precursor to it as it can play an important role in helping define the scope of your project. A rough outline of relevant project activities might look something like this:

1. outline your project definition;
2. define the baseline;
3. refine your project definition in the light of the outcomes of baselining;
4. identify where you hope to make improvements;
5. identify how you will measure improvement and what sources of evidence you will collect;
6. design your evaluation plan;
7. conduct the project and post-project evaluation;
8. compare end result with the baseline.

<sup>168</sup> Learning and Skills Council (2002) *Guidance on College Property Strategies*: [http://dera.ioe.ac.uk/13355/2/Supplement\\_A\\_to\\_Circular\\_02-20\\_Guidance\\_on\\_college\\_property\\_strategies.pdf](http://dera.ioe.ac.uk/13355/2/Supplement_A_to_Circular_02-20_Guidance_on_college_property_strategies.pdf)

Step seven is by far the largest element of the project and will consume most of the time and resources but baselining and evaluation are the activities that show the project was worth doing at all. They assume increasing importance in the current climate: baselining can help you ensure you tackle the right issues, in the right way, involving the right stakeholders and evaluation can ensure you deliver the expected benefits and capture the essential learning for your next project.

The benefits of capturing a baseline include:

- **Getting project scope right** – baselining gives you an opportunity to refine the scope of your project. Sometimes you will realise you cannot solve a particular problem without tackling one or more related issues.
- **Identifying project stakeholders** – baselining can help avoid you finding a *skeleton in the closet* further down the line in the form of a stakeholder you should have consulted but missed.
- **Managing and communicating project scope** – baselining helps you manage stakeholder expectations of your project. You may need to make it clear that certain issues are out of scope if you are not to disappoint certain stakeholders.
- **Challenging myths** – sometimes baselining activity can reveal myths and fallacies that need to be challenged before you can move forward. Often they relate to unspoken assumptions about what aspects of practice, processes and systems can and cannot be changed: remember, “*We’ve always done it that way*” is neither a reason nor a justification.
- **Showing evidence of improvement** – you cannot show how far you have travelled unless you know where you started.

It may be relatively easy to establish and compare against a baseline where you are refurbishing an existing space with facilities of a similar type and scale. The situation becomes more difficult when you are implementing a space that is new and/or radically different but, in these cases, it is probably even more worthwhile. If you are undertaking this type of significant investment you need to be sure that it is really having an impact on things that matter.

## 6.5 Gathering and sharing information

Many factors impact on the choice of evaluation methods and time and budgetary constraints are prominent amongst them. Quantitative information is relatively easy to gather these days and data collection may be automatically available from systems such as those managing swipe card access or registering users of the network. The choice of relatively traditional evaluation techniques and particularly automatically generated occupancy data is a pragmatic one for many evaluators resulting in *quick wins*.

Such data will however need to be supplemented by observational and behavioural analysis to gain any real insights into student and tutor practices in new learning spaces. Ethnographic approaches<sup>169</sup> have been used in some areas: Edge Hill University chose to take an ethnographic approach to evaluating their SOLSTICE space<sup>170</sup>; the approach included observation of sessions, student focus group interview (followed by further paper-based questions) and tutor reflections. Other universities have used photo snapshots taken at regular intervals to record the configuration of furniture and the uses to which the space is being put.

Other methods of gaining user participation in evaluation include:

- video diaries;
- user blogs;
- graffiti walls.

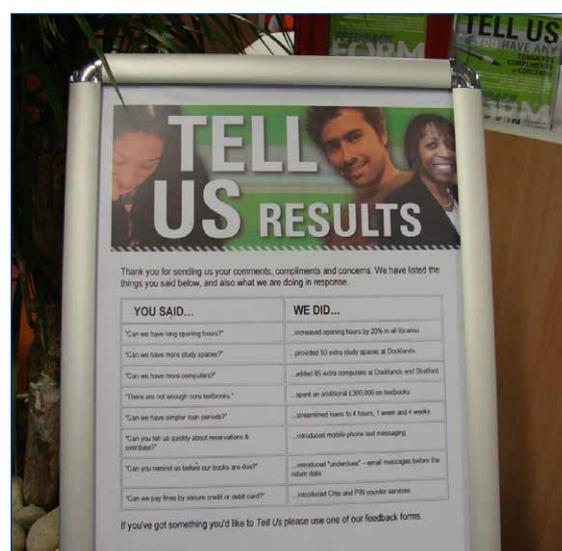


Photo 15: Responding to feedback at the University of East London.

<sup>169</sup> Ethnographic approaches involve research that tries to understand behaviours from an insider perspective rather than imposing external models. Such approaches usually rely on multiple sources of evidence.

<sup>170</sup> <http://tools.jiscinfonet.ac.uk/downloads/lsd/solstice-presentation.pdf>

Universities planning behavioural and observational approaches should bear in mind that such evaluations may be covered by their research ethics policy and require prior approval by the research ethics committee.

Once you have undertaken an evaluation it is good practice to share information about how you acted on the feedback with users of the space. This can be as simple as putting up a poster as in the example above from the University of East London.



### VIEWPOINT

**Jean Mutton, formerly Student Experience Project Manager at the University of Derby and now a service design consultant**, realises there is often a discrepancy between what students want and need and what managers think they want. Service design approaches<sup>171</sup> can be very helpful in taking a systematic approach to meeting user needs. Jean is very cautious about surveys because you only get answers to the questions you ask. She suggests that you should try to be to be very open ended when designing evaluation questions, so that people say what they really think. The timing of surveys can also be an important factor in the answers you get e.g. students who are very happy with the library facilities and opening hours at the start of term may have a different view following an intensive assessment period. It is also important to be sure we are measuring the right things e.g. service help desks are often pleased with how quickly they answer the phone and the number of queries they respond to, rather than looking at *failure demand* i.e. why they are receiving the queries in the first place?

At Derby one of the surprising uses of some relatively high tech collaborative group spaces, the learning pods, was that early in the morning there appeared to be *breakfast clubs* popping up where groups of students would meet with bacon sandwiches. This appeared to be as much of a social gathering as learning, which caused the university to think about why they were doing that, and whether there were issues with other aspects of space provision on campus.



### VIEWPOINT

**Caroline Pepper, Learning and Teaching Space Manager, Loughborough University**, questions the emphasis that the sector as a whole puts on space utilisation figures when evaluating effective use of space. She feels that it is difficult to trust the way the figures are reported as the methodology varies between institutions. Some universities only report on lecture rooms that have a capacity of 100 or more which are generally heavily used. She also suggests that simply increasing utilisation is not the complete answer to better use of space. There is a balance to be achieved. Increasing utilisation can have a negative impact on student experience and this is illustrated on a continuum.



Loughborough utilisation figures are always steady at around 33-35% which is in the top 15% for the sector, but Caroline believes its utilisation figures for pool spaces should not be increased further (to avoid losing flexibility to timetable according to teaching type and pedagogical style rather than simply how many people you can fit in the room). She is more focussed on analysing all learning and teaching spaces and their effective use, this includes school controlled spaces and informal learning areas, which cannot be measured easily by utilisation statistics.

Caroline emphasises the need to evaluate things that actually impact on learning and is looking at adding specific questions on learning spaces to module feedback forms. One simple change that Loughborough made in response to student feedback was in the fact that rooms used to be timetabled for teaching and then locked during holiday periods. Student survey data showed that students were lacking places to study so students can now view an online timetable and access teaching rooms when they are not in use. This is something that was easy to achieve.

171 Baranova P., Morrison S., Mutton, J. (2010) *Service Design in Higher and Further Education: A Briefing Paper*. Jisc: [http://wiki.cetis.ac.uk/images/8/82/Service\\_Design.pdf](http://wiki.cetis.ac.uk/images/8/82/Service_Design.pdf)



## VIEWPOINT

**Sally Jorjani, Head of Academic and Business Liaison, Edinburgh Napier University**, used observational evaluation techniques to help in the planning for some new types of social space in and around the reception areas on Edinburgh Napier's three campuses. Time lapse filming took place over a period of a week on each of the campuses and this was supplemented by some physical observation. The observations revealed that students were doing different things on each of the campuses and that this was related to different teaching and learning practices in the different discipline areas on each campus as well as the fact that each attracted a different student demographic. The university already had information about student ownership of devices from an earlier survey but the observations gave them insights that they hadn't picked up from the survey. The survey revealed that many students have up to three devices but the observations gave a much richer picture of what devices they used for what activities and in which locations on each campus. This evaluation evidence was helpful in demonstrating the need for the project.



## VIEWPOINT

**Toni Kelly, Associate Director, Learning Environments, University of Hong Kong**, stresses the importance of keeping a lessons learned log. She told us *"You not only need permission to create new spaces but you need permission to go back and put things right"*. Often this is simply down to students finding new and unexpected ways to use the space, the furniture or the technology. Toni said *"No matter how careful we have been about creating spaces to meet students' needs and expectations, they always manage to use them in ways we had not thought about!"*.

## Resources

- Mind map showing evaluation activities undertaken for the University of Warwick Learning Grid<sup>172</sup>.
- A 2007 Jisc study of effective evaluation models and practices for technology supported physical learning spaces containing a framework for evaluating learning spaces<sup>173</sup>.
- The Educause Learning Spaces Rating System provides a set of measurable criteria to assess how well the design of classrooms support and enable active learning activities<sup>174</sup>.
- A 2011 literature review on the evaluation of learning spaces<sup>175</sup>.
- The Swinburne University of Technology Toolbox database provides a comprehensive set of examples of learning space evaluations undertaken using a variety of different methods<sup>176</sup>.
- McGill University video on post-occupancy evaluation of their active learning classrooms<sup>177</sup>.
- Canterbury Christ Church University implemented a laptop borrowing scheme and used the data from that to understand more about how students were using the laptops within networked learning spaces. The evaluation won them the 2009 UCISA Award for Excellence<sup>178</sup>.

172 <http://tools.jiscinfonet.ac.uk/downloads/ltd/learning-grid-evaluation.pdf>

173 Pearshouse et al (2009) A Study of Effective Evaluation Models and Practices for Technology Supported Physical Learning Spaces. Report produced for Jisc: <http://oro.open.ac.uk/29996/2/>

174 [www.educause.edu/eli/initiatives/learning-space-rating-system](http://www.educause.edu/eli/initiatives/learning-space-rating-system)

175 Lee, N., Tan, S. and Tout, D. (2011) Evaluation Learning Spaces Literature Review. Swinburne University of Technology: [www.swinburne.edu.au/spl/learningspacesproject/outcomes/files/ELS%20Lit%20Review.pdf](http://www.swinburne.edu.au/spl/learningspacesproject/outcomes/files/ELS%20Lit%20Review.pdf)

176 [www.swinburne.edu.au/spl/learningspacesproject/database/index.html](http://www.swinburne.edu.au/spl/learningspacesproject/database/index.html)

177 [www.mcgill.ca/tls/spaces/alc](http://www.mcgill.ca/tls/spaces/alc)

178 [www.ucisa.ac.uk/~media/Files/members/awards/excellence/2009/CCCU%20pdf.ashx](http://www.ucisa.ac.uk/~media/Files/members/awards/excellence/2009/CCCU%20pdf.ashx)

# 7 Change management and transition



## THIS SECTION AT A GLANCE

- we review approaches to change management and identify those that may be effective in a learning space project;
- we consider the kind of changes that may be necessary to effectively manage new learning spaces in the longer term;
- we look at the support both staff and students may need to make effective use of the new space.

## Expectations from reading this section

One of the key messages from the contributors to this Toolkit who talked to us about project management and stakeholder engagement was that learning space projects are change projects. In this section we try to identify the types of change that may invoke a deeply personal and emotional response from stakeholders and which can lead to resistance if not handled effectively.

In particular we suggest that:

- you should not underestimate the time and resources that need to go into change management activities;
- you should not expect a project manager with a background in construction (whether they are internal or external to your organisation) to be a specialist in change management: they will need expert support;
- effective change is participatory but it needs to be led. Senior management leadership and support should be robust and visible.

Creating new types of learning space can demand a major exercise in change management to ensure that the stakeholders are able to make effective use of the space. In Section 2, Working in partnership, we discuss creating the right conditions for stakeholder participation so that all relevant views can be heard and taken into account. It is to be hoped that a highly participatory approach to developing the vision for a new learning space in the first place will be successful in getting many stakeholders on



*“[Some] universities share a legacy of trying to reflect new pedagogic approaches with lots of resistance to change.”* Toolkit contributor

board from an early stage. Nonetheless, in a long and complex project, stakeholders will come and go throughout the life of the project and the amount of people directly involved in consultation may still represent only a small number of the overall users of the space.

Making the best use of a new type of space might involve a significant number of people in developing new working practices, delivering services in a new way, and/or changing their notions of ownership and control.

Much has been written about change management in higher education. The Jisc guide<sup>179</sup> on the subject discusses a common model that identifies five different strategies to effect change:

1. **Directive strategies** — this approach highlights the manager's right to manage change and the use of authority to impose change with little or no involvement of other people.
2. **Expert strategies** — this approach sees the management of change as a problem solving process that needs to be resolved by an expert.
3. **Negotiating strategies** — this approach highlights the willingness on the part of senior managers to negotiate and bargain in order to effect change.
4. **Educative strategies** — this approach involves changing people's values and beliefs by a mixture of persuasion, education and training.
5. **Participative strategies** — this approach stresses the full involvement of all of those involved in, and affected by, the anticipated changes. The views of all will be taken into account before changes are made. Outside consultants and experts can be used to facilitate the process but they will not make any decisions as to the outcomes.



*“Most of us can “read space” and draw an impression of what may or may not be permissible in a particular room. Old style and unattractive classrooms with a rigid or fixed layout excludes ad hoc use by students, on the other hand modern spaces invite students in.” Toni Kelly*

Given a highly participatory approach to the development phase of the project, it is expected that a continued emphasis on participation along with educative strategies is the approach that most universities will take.

## 7.1 Resistance to change

There is also a significant amount of research into change management that identifies transition as distinct from change and suggests that it is often the pain of transition rather than the actual change itself that people tend to resist. This may be particularly prevalent in a learning space context where people are giving up space that has been *their own* for a long time or where they are going through the upheaval of lengthy and disruptive construction work going on around them.

This process has been likened, psychologically, to the grieving process and everyone deals with such major changes in their own way. Each stage in the process needs to be recognised and responded to accordingly. For example, it is no good expecting grudging acceptance when staff are still in shock that their old building is to be demolished.

Change, particularly in areas such as teaching or administrative practice, can also be seen by some people as devaluing their previous experience. This may explain why younger staff, who may have invested less time and effort in learning the old ways, can find it easier to adapt to the new.

It is important to think where the resistance is – is it individuals or the structures and systems they are within that resist change? We need to avoid the simplistic understanding that tends to position teachers as either barriers or agents of change. (See Priestley, 2011)<sup>180</sup>.

<sup>179</sup> Jisc (updated 2014) *Change management, The theory, methodologies and techniques to help manage change effectively*: [www.jisc.ac.uk/guides/change-management](http://www.jisc.ac.uk/guides/change-management)

<sup>180</sup> Priestley, M. (2011) *Schools, teachers, and curriculum change: A balancing act?* *Journal of Educational Change*12:1-23: <http://dspace.stir.ac.uk/handle/1893/2522#.VjO9sDZdGHs>

These are some of the things the Toolkit contributors told us about change:

- Academics are sometimes very uncomfortable about moving away from serried ranks: they don't have the skills required to teach in the new spaces.
- Some people are very set in the mind set of having people in rows and think they can't teach any other way.
- A tutor who hates the room can have a poisoning effect on students.
- You even need counselling skills as a lot of time is spent giving reassurance and walking people through change.
- *"You need a strong forehead to withstand brick walls."*
- You need to have a vision, to pick your battles and to have a passion for the job to carry you through the barriers.
- People don't like change so you need to build a positive, persuasive case and to be persistent.
- Schools are very protective of *their own* spaces although some of them are no longer relevant to their needs and don't support current learning and teaching requirements.
- Projects can be very long and needs do change, but change is bureaucratic and it is easier not to deviate from the original plan.

Jisc has identified some conditions that are more likely to cause people to embrace and welcome change<sup>181</sup>:

- We propose the change;
- We are involved in the design of the change;
- We feel that our opinions and views are heard, and contribute to the new reality;
- We benefit from the change;
- The organisation benefits from the change;
- The students benefit from the change;
- The wider community benefits from the change;
- We dislike the present status quo;
- We are confident about our competence in the new context;
- We trust/respect/like the person/group proposing the change;
- We can see the big picture and how the change contributes to it;
- We are given support and time to adjust to the changes;
- We are not expected to change too many things at the same time;
- Change is spaced;
- We understand the reasons for the change;
- We believe the change is important;
- We believe the change is necessary.

<sup>181</sup> Jisc (updated 2014) *Change management, The theory, methodologies and techniques to help manage change effectively*: [www.jisc.ac.uk/guides/change-management/resistance-to-change](http://www.jisc.ac.uk/guides/change-management/resistance-to-change)

## 7.2 Professional development

We have talked in previous sections about the need for the institution to have shared values about the types of pedagogy it wants to encourage and the need to design new spaces that are highly intuitive for users. In spite of this it is not sufficient simply to create the spaces and leave people to *get on with it*. Some form of support is likely to be necessary in any innovative development: this does not necessarily imply an extensive training programme, it may be as simple as pointing people to sources of inspiration about the new possibilities.

Academic staff who have been used to a didactic form of teaching delivery may need time and support to adapt to techniques such as active and problem based learning. They may want to see evidence that this form of learning is effective elsewhere and/or they may lack confidence in their own abilities to adapt their teaching style. The idea of teaching in a space that does not have a defined *front* does represent a significant cultural shift. A common complaint is that lecturers do not like students having their backs to them in group spaces. Similarly, staff who have been trying alternative approaches in inappropriate space will also need time to hone their developing practices in new space.

We discuss issues relating to timetabling elsewhere in this section. A significant factor in determining whether it is worth academics investing time and effort in trying new teaching styles and learning to use new technology is whether or not they have access to the new spaces sufficiently often to make it worth their while adapting.

In some cases the barriers to using new technologies are fairly easily overcome. Aberystwyth University stopped using the term *visualisers* and renamed the devices digital overhead projectors. This resulted in an increase in usage because lecturers suddenly understood what they were for.

Peer encouragement, support and mentoring are effective ways of changing academic practice. The University of Derby built its first experimental classroom in 2011 and the academic staff who did the trials on that project went on to become *critical friends* for other learning spaces projects. They were a self-selecting group and tended to be people who were more digitally capable and happy to take risks.

James Rutherford and Matt Sherlock at the University of Birmingham also emphasised to us the value in sharing academic practice as a means of change management:

*“Going and seeing what other people are doing is key. Horizon scanning and looking outside is also useful. Ideally you want to take representative academics on visits to see that other high ranking universities are doing things differently (although seeing what other people get wrong is useful as well). Sharing best practice with other academics is very important”.*

Customer service teams in all of the professional services also have a vital role to play to support and encourage the use of technology and flexible learning spaces. Their role is evolving to go beyond functional support to promoting change to pedagogy and providing encouragement, enthusiasm and passion for new approaches.

## 7.3 Student support

In general students appear to have fewer difficulties than staff in adapting to new learning spaces and finding appropriate ways of working within them. There are however some important caveats here. Some types of student find some types of learning activity takes them out their comfort zone. It is particularly evident that international students from a number of parts of the world are used to a didactic mode of teaching and have difficulty initially in adapting to collaborative learning and hence in learning space evaluations they tend to rate the group spaces less highly than other students. The issues are not however related to a single cultural group as techniques such as peer review, which research has shown to be highly effective in enhancing deep learning, can be unpopular with a wide range of students who are unfamiliar and uncomfortable with the approach.



*“Building is the easy bit; the hard bit is in developing the staff skills to use the space effectively.”* Simon Birkett



*“There are interesting challenges around IT ownership in that technologies are issued to staff related to their status and grade so a Dean might get an iPad and a new lecturer be left with paper and pen. There is an interesting and strategic conversation to be had. If we expect staff to be digitally capable in the classroom then we need to give them the right tools.”* Toolkit contributor

Addressing these issues is part of a wider agenda of learning literacies. We have suggested elsewhere in this Toolkit that those designing space should think about what kind of graduate outcomes they are looking to achieve and how particular pedagogic approaches and learning spaces can support this. The relevance of different learning approaches to graduate outcomes, the development of transferable skills and hence future employability, needs to be emphasised to students from an early stage to help them make the most of their time at university.

Students may need some support in understanding the kinds of things they can do in new learning spaces. As an example, the University of Derby created and evaluated a number of comparatively high tech *learning pods* for group work. In conducting the evaluation they employed a student to undertake observation of the activities going on and he identified that students were initially not using the full functionality available. Part of the reason for this was that it was not immediately obvious what you could do with the technology to support learning. As a result of the evaluation, a competition was held amongst the graphic design students to devise a *crib sheet* for each pod to indicate its potential uses to students.

A similar issue was encountered when Durham University opened its Techno-Café<sup>182</sup> in 2005. This space consisted of some very high tech *learning pods* designed to support active and collaborative learning for computing students. The facility was first used by second year students. They liked the facility but, after sitting for a while, they would go back to the old style computing labs to individually work on parts of the projects and compare notes later. Later trials with first year students and schoolchildren found they were much more accepting of collaborative work and had more ideas about how they could potentially use the space. The issue seemed to be that the second year students had become indoctrinated into the old way in which they operated. They were used to working individually and only communicating when they had completed their individual tasks and it was very hard to encourage them to use any other approach to working.

## 7.4 Managing learning spaces

As well as taking a partnership approach to developing learning spaces, many universities are realising that there are considerable benefits in greater collaboration when it comes to designing the overall space envelope and looking at how that is managed on a day to day basis. This kind of approach can however also be a major exercise in change management. Many of our contributors have promoted the idea of developing a portfolio of learning spaces with teaching rooms of varying sizes that can be adapted to a range (but not an unlimited range) of teaching types.

One of the problems in implementing such an approach is simply knowing what teaching space the university has at its disposal. Most universities have some centrally managed space but the proportion that is *privately owned* by schools or departments can be quite significant in some cases. We heard of one example where, quite recently, only 4% of general purpose teaching spaces were managed centrally and we were told “*We know there are inconsistencies about the quality of space and the support for students*”. Another institution currently has around 50% centrally managed space but says that as for the rest “*We have no say in what the individual schools do, no understanding of what they have done and can’t get a look in the rooms to see*”.

This lack of transparency about devolved space has a direct impact on student support and the student experience. If central service managers cannot obtain information about the spaces then consider how much more difficult it is for students. We heard that students find it difficult to identify places where they can go to study, difficult to find out whether there are IT facilities available in the space and almost impossible to find out what software will be available on any computers that are provided and whether it is available to all students or *locked down* to users from particular subject areas.

These issues can be even more complicated where an institution has grown as a result of mergers and takeovers. In these cases component institutions are quite likely to continue to *do their own thing*. It will generally be a lengthy and costly process to standardise equipment and software. In the meantime students may struggle to find out what facilities are available to them and lecturers may struggle to adapt to new technologies. In some cases this may cause resentment where they have invested considerable time and effort in learning to use their previous tools.

The University of Strathclyde realised the risks posed by too much devolution in space management and underwent a major exercise in change management as a result of a fire that took 50 teaching rooms out of use for 18 months (see Viewpoints below).

Many universities are making use of virtual desktop technology to ensure that students have access to the same software facilities on any device they use whether at home, on campus or elsewhere.

<sup>182</sup> [www.dur.ac.uk/alice/technocafe/](http://www.dur.ac.uk/alice/technocafe/)

## 7.5 Timetabling

Ask about the major operational issues in any university and, after car parking, the next most common answer is likely to be timetabling. The kind of portfolio approaches outlined above can be a big help in resolving timetabling issues but the timetable can nonetheless be a barrier to changing learning and teaching practice.

Whether we have ambitious ideas about flexible space or a pragmatic approach to limited adaptability, the timetable imposes constraints. A teaching hour can amount to anywhere between 45 and 60 minutes in different universities. Change over time is needed to allow students to move between rooms and also to allow for any reconfiguration of the room layout. In practice, even with the most flexible furniture, it is difficult to change a room layout without losing valuable class time.

Simon Birkett, IT and Learning Technology Manager, University of Staffordshire, has encouraged wider thinking to address this problem by designing bespoke furniture: all chairs are on wheels and all tables have two of their four sides on wheels. Locks on wheels have been removed, as moving a group of four tables together could mean undoing 12 locks to move the tables.

In some cases new learning spaces can be a source of discontent when academics try out the new spaces and like the opportunities they offer but then find they are not able to have the same facilities as often as they would like. It can be a challenge for somebody who has developed an active, group learning approach to find themselves back in a room with rows of desks facing the front. If you create only one of any type of space then you are setting yourself up for issues with managing expectations. Loughborough University experienced such problems with the creation of the innovative Design School lecture theatre. Once you have increased expectations, you need the physical resources to manage them. You need to be able to balance different styles of spaces from a timetabling perspective and the creation of fantastic new spaces will also highlight any inadequate learning spaces you may have.

Feedback from Toolkit contributors' learning space evaluations included a variety of opinions comments from: *"There have been a number of projects to look at timetabling in recent years but they haven't really got off the ground. There are probably too many cooks involved. We have quite a traditional approach."* to *"... the way our timetabling works, it's very hard to change a room. If you think on Monday, I'd really like to do that on Thursday, and you know it's going to be a battle, you're much more likely to think 'oh forget it'"* and *"It's difficult because I sat down and looked at the timetables for next year and tried to identify where I'd be able to use that room, and we were slightly held back by timetabling."*

Timetabling should be an enabler, rather than the barrier it is considered to be in some institutions. The more the timetabling team are embedded in and part of discussions about delivery developments, the more they will be able to translate individual (often changing) requirements to deliver the right space at the right time. Some timetabling teams use a student data-driven approach and to offer a greater degree of flexibility in course design (through module choices etc.); others capture requirements for future cohorts and forward model for new and existing flexible learning spaces that will be in use in three academic years' time.



Photo 16: A collaborative type of lecture theatre at Loughborough University Design School. It has been defined as a 'Harvard hybrid'.

© Loughborough University



*"The creation of this style of space has positively challenged the way we teach. The layout enables students to be engaged in a more effective way".*  
Dr Julie Holland, Loughborough University<sup>183</sup>

<sup>183</sup> Feedback from Dr Julie Holland, Director of the Glendonbrook Centre for Enterprise Education, on Loughborough University's new lecture space.

## 7.6 Changing working practices

New learning spaces may encourage or demand new ways of working. Here are some examples:

- Simon Birkett, IT and Learning Technology Manager, University of Staffordshire, was surprised to find that in an institution he worked in previously, teaching staff were using their learning pods (areas designed for collaborative work by small groups of up to ten students) for seminars. The academic staff liked the space and found it more convenient than having to timetable a room.
- Some universities are realising that the need to teach very large cohorts only occurs for a short periods during the year. An example is large teacher training cohorts who are together for a short time at the start and then spend most of their time out on placement. One university has calculated that it has a requirement to teach these huge classes for only about 35 hours in the year. Rather than building large lecture theatres to meet this type of infrequent need, other options can be considered. For example it may be appropriate to hire a large external venue (if one is available nearby), or to arrange streaming of lectures between adjacent rooms, to change the course delivery strategy to include more online sessions, or simply to break the cohort down and repeat the teaching in separate rooms. Repeating the classes, of course, may be unpopular with the lecturers.
- Glasgow Caledonian University implemented a one stop shop for student support in the Saltire Centre. Administrative and support services were colocated in an open plan area on the ground floor of the learning resource centre. The service desks had coloured lighting built in to signal whether they were in use by staff or vacant and available for student use. The configuration was changed, using cupboards to enclose the rear of the service desks, due to staff concerns about data protection when computer screens were visible in the open plan space.
- The University of Strathclyde IT Services department has found that increasing room utilisation means it is harder to find times when you can fit in maintenance. Their solution has been to change working patterns so that some staff now start at 7 am and use the 7-9 am window for maintenance.



### VIEWPOINT

**Bruce Rodger, Head of Infrastructure, Information Services, University of Strathclyde**, is very much in favour of a portfolio approach to designing and managing teaching rooms. He is clear that a one size fits all approach won't work and that you need a selection of types and sizes but he points out that *"The matrix should never be so big that you have unique rooms"*.

At Strathclyde the university has been taking steps to bring the private departmental space into the central family to help with this kind of portfolio management. One of the key drivers for this was a fire in 2012 which took 50 teaching rooms out of use for a period of 18 months. The fire made Bruce realise that university disaster recovery plans tend not to think seriously about learning spaces. Existing plans focus very heavily on business continuity and IT but, even in a city centre location, where can you find 50 classrooms in a hurry?

At one point immediately after the fire, the university was teaching in cafes and in a cinema. The cost of hiring a 600 seat cinema in the morning was surprisingly cheap, and the projection facilities were very good, although extra lighting had to be brought in so students could take notes and external wifi was needed. Students liked the novelty of the approach and there was a bit of a *Dunkirk spirit* about the whole experience which meant that the university did not suffer in the NSS as a consequence of the disaster. It did however give the university a different perspective on both disaster planning and how it needed to manage its teaching space.

Bruce says *"I wouldn't recommend having a fire as a catalyst for change but it certainly worked for us"*.



## VIEWPOINT

**Sally Jorjani, Head of Academic and Business Liaison, Edinburgh Napier University**, found that a project to create social learning spaces in a number of reception areas was in itself an exercise in change management. Fortunately she had robust evaluation evidence (see Section 6, Evaluation) to demonstrate student need. She did however experience the well known project management conundrum that a benefit for one type of stakeholder may be a *disbenefit* for another. In this case, the fact that the reception areas had been furnished and effectively given over to student control reduced flexibility for professional services departments that had previously been able to book out the space and make use of it for certain activities at particular times of year. Key to ensuring the success of the project was working closely with the services and demonstrating the overall value in terms of benefit to students and thinking about the space as multifunctional e.g. considering how furniture could be reconfigured to meet regular but less frequent needs.



## VIEWPOINT

**Paul Burt, Learning Spaces Service Owner, University College London (UCL)**, told us that UCL had started an initiative called *meet and greet* to help lecturing staff make best use of the facilities available in each classroom. For the first two weeks of term an experienced member of staff, who knows how the equipment in that particular room works, is present in every teaching room for the first 10 minutes of every class. This helps lecturers who are either new in post or new to teaching in a particular space to iron out any teething problems with the equipment. This initiative has been very well received because this is the busiest and most stressful period of the year when almost all of the students turn up to classes and many lecturers are teaching in rooms that are unfamiliar to them.

## Resources

- The UCISA Project and Change Management Group has a mailing list and variety of publications<sup>184</sup>.

<sup>184</sup> The UCISA Project and Change Management Group: [www.ucisa.ac.uk/groups/pcmg](http://www.ucisa.ac.uk/groups/pcmg)

## 8 What's next?

This Toolkit has focused on the most common types of learning and teaching space in universities (with the exception of library and learning resource centres which have long been at the forefront of innovative learning space development and are already well documented). There are however many other areas where innovation is taking place:

**The University of Liverpool** has taken the bold step of developing Central Teaching Laboratories (CTL)<sup>185</sup> where space, equipment and technical staff are shared across physical and environmental science subjects. The sharing of equipment means that the University can supply more and better technical equipment for its students. Some items that were unaffordable for use by small groups can be viewed as a sound investment when used by large numbers. This means that some departments have access to facilities that were previously unavailable to them. Savings made on the bulk purchase of equipment also mean that the University can now loan items of equipment to students.

The key benefit is the better quality resources available to all disciplines and the curriculum change that this facilitates. More problem based learning is being introduced in some areas to reflect life as a working scientist. Students need to understand the problem they are trying to solve, decide what laboratory observations would provide answers and design and evaluate their own experiments. This is very different to traditional laboratory teaching where the teacher has already made most of these decisions and thus provided the *recipe* to be followed.

Space utilisation is more efficient: the University has a laboratory space utilisation rate of around 48% compared to a sector average of around 20%. Maintenance and staffing costs per square metre are lower than for the previous dispersed laboratories even though the new facilities are of much better quality. First and second year physics students now have 30 to 50% more practical work than previously and there has been an increase of 35% in student numbers in physical and environmental sciences with no need for an increase in technical support staff. The CTL won the 2012 S-Lab New Laboratory Building Award<sup>186</sup> and the 2013 Guardian University Best Facilities Award<sup>187</sup>.



Photo 17: The Central Teaching Laboratories at the University of Liverpool promote interdisciplinary collaboration.

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<sup>185</sup> [www.liv.ac.uk/facilities-management/campus-development/central-teaching-labs/](http://www.liv.ac.uk/facilities-management/campus-development/central-teaching-labs/)

<sup>186</sup> [Effectivelab.org.uk](http://www.effectivelab.org.uk) (2012) *The Effective Laboratory: Safe, Successful and Sustainable - Results of the 2012 S-Lab Awards and Conference*: [http://www.goodcampus.org/files/files/83-117899\\_SLAB\\_Conference\\_Results\\_V10\\_12.pdf](http://www.goodcampus.org/files/files/83-117899_SLAB_Conference_Results_V10_12.pdf)

<sup>187</sup> *The Guardian* (2013) *University facilities winner: University of Liverpool*:

<http://www.theguardian.com/higher-education-network/2013/feb/26/university-facilities-winner-university-liverpool>

**Nanyang Technological University** in Singapore opened its eight storey Hive<sup>188</sup> building in August 2015. This is a student focused building with no doors at all (although there are security staff in the building). The Hive contains study spaces and classrooms designed for a flipped classroom approach. This university thinks that in two to three years' time they will be doing no lecturing and all courses will be based on small group collaborative learning.

**Nottingham Trent University Library** opened a roof garden learning space in 2015. Students appreciate being able to work out of doors whenever possible even in the UK climate and outside space should be regarded as potential learning space.

Student accommodation is a topic that merits further attention. James Rutherford, Learning Spaces Development Manager, University of Birmingham, reminded us that institutions have a responsibility to residential students to be a *home from home* and to make students comfortable, yet some accommodation is less than homely. James feels that a relatively untapped area at present is the idea of creating more informal learning spaces in halls of residence, *“so they become more than just housing blocks”*.

Socio-constructivist pedagogies such as active, problem based and enquiry based learning are also being promoted in innovative types of space known variously as maker spaces, innovation commons, tinkering spaces and hacking spaces that are growing in currency in the US, particularly in schools, libraries and community centres<sup>189</sup>. They are places for self directed, peer to peer and collaborative project based learning arising from informal, unstructured activity focused on creativity, exploration, play and problem solving. They often have a technical or science focus and may house equipment such as 3D printers and Raspberry Pi microcomputers<sup>190</sup> but they can equally have a creative arts focus. Some university maker spaces house equipment such as engineering and woodworking tools and safety training may be a prerequisite for using the space.

The MakeSpace<sup>191</sup> at University College London is one example from the UK; Barrett et al (2015)<sup>192</sup> have summarised Maker spaces in US universities and there is a useful website on Maker spaces and 3D printing in US libraries<sup>193</sup>.

Toni Kelly, Associate Director, Learning Environments, University of Hong Kong, views evaluation as part of a continuous learning process and her philosophy is always to want to make the next learning space better than the last one. She finds countless sources of inspiration for this: *“There are so many people doing such brilliant things - you think you've got all the bases covered then you come across somebody doing almost the same thing but by adding a bit of technology or a bit of creative design they have made it better. You might call it 'space envy': we are always searching for perfection”*. Toni is excited by a range of new developments such as innovation commons, maker spaces and tinkering spaces. Her message to readers of this Toolkit is that the good practice guidance here is only a start: *“We need to make it clear that this isn't the end and more is coming...”*.



Photo 18: Roof garden learning space at Nottingham Trent University.

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188 <http://media.ntu.edu.sg/NewsReleases/Pages/newsdetail.aspx?news=a161986e-ddb6-47de-8cf6-25264cefd934>

189 [https://en.wikipedia.org/wiki/Maker\\_culture](https://en.wikipedia.org/wiki/Maker_culture)

190 [www.raspberrypi.org/](http://www.raspberrypi.org/)

191 [www.instituteofmaking.org.uk/makespace](http://www.instituteofmaking.org.uk/makespace)

192 See Barrett et al (2015): A Review of University Maker Spaces. American Society for Engineering Education: [https://smartech.gatech.edu/bitstream/handle/1853/53813/a\\_review\\_of\\_university\\_maker\\_spaces.pdf](https://smartech.gatech.edu/bitstream/handle/1853/53813/a_review_of_university_maker_spaces.pdf)

193 <http://library-maker-culture.weebly.com/makerspaces-in-libraries.html>

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