

Chapter Three – Current Practice, Trends and Visions of the Future

Introduction

Analysis of nearly 90 surveys, desk research and visits to 15 sites across the sector show that learning spaces are highly diverse. It could be said that the only thing they have in common is that they are unique. However, it is helpful, for analysis, to categorise learning spaces. This study uses four categories; teaching spaces, open access spaces, social spaces and other learning spaces, these categories are explained more fully later in the chapter. It may be that many of these spaces serve different purposes at different times, such as computer teaching rooms that double up as open access clusters outside teaching hours, and also that the location of these rooms with respect to each other, such as clustered into central 'Learning Resource Centres' or distributed into subject areas, will also have an impact on how they are used and the technology that is needed with them.

Looking at the influence of learning technologies on the design of physical learning spaces shows that space which is now being planned will still be in use, with much of the same furniture and equipment, in five years time. However, five years is a long time in terms of technology. Moore's Law [see <http://www.intel.com/research/silicon/mooreslaw.htm>] suggests that, depending upon the precise application of the law, computing power will increase by a factor of between 10 and 30 in that time. There are, however, many technological advances that have been available for a number of years, such as wireless networking, the wireless standard IEEE 802.4L developed into the current 802.11 set of standards as far back as 1977 see http://www.staff.ncl.ac.uk/i.g.clark/async/coherent/publications/ACD_bluetooth_stpetersberg_5-2002.pdf; Davies, A] and video conferencing, dating back to 1930 [<http://www.internet2.edu/presentations/20010308-I2MM-GettingStartedEndUsersDetails.PDF>; Poe, T; Yafchak, M F], but are only now becoming widespread and would still be seen as emerging technologies in terms of their use for learning and teaching. Yet, other technologies move very rapidly from the drawing board into the classroom, video recorders, digital cameras, Virtual Learning Environments and PowerPoint are good examples of technologies that have reached the classroom within a very short time of being developed.

So the five year planning horizon is fairly clear, with the caveat that design still needs to be flexible. It is beyond the five year horizon that it is very difficult to predict. The "Vision of the Future", presented at the end of this chapter provides some useful pointers, but perhaps the most relevant single piece of advice that came from our site visits was to "Expect the Unexpected" [Senior member of staff – Site Visit, York College].

Overall Trends

Before looking in detail at different types of space it is worth considering some of the overall trends, both technological and pedagogic, that are likely to influence the use of learning technology and the design of learning spaces.

- Increasing demand for access to online services and information, leading to a continuing need to invest in IT facilities.
- Moore's Law suggests that computing power will increase by a factor between 10 and 30.
- Extended opening hours for physical spaces, and associated services such as helpdesks, will be considered increasingly necessary, this also enables better overall use of expensive space and mirrors the wider move to a 24/7 culture.
- Staff and student training and support will continue to be important, in order to facilitate effective use of learning technologies.
- Personal and home computing, particularly for communications, will increase. This will include:
 - Faster broadband
 - Voice over IP
 - IP Television
 - Video Conferencing
 - High speed mobile phone connections

These changes will offer new pedagogic opportunities and are likely to affect pedagogic practice, in both physical and virtual learning spaces.

Teaching Spaces

Teaching space, for the purpose of this report, covers any space that is used primarily for directed learning activities, usually during a set time with a tutor present. Teaching spaces can be large lecture theatres, seating over 300 students, or small seminar rooms, designed for ten or fewer. Configurations and equipment can vary considerably. Teaching spaces include science laboratories, computer rooms, workshops and other practical teaching areas - such as kitchens and hair-dressing salons.

Below are two examples of laboratory teaching spaces, as they used to be. The scientific 'wet-lab' in Figure 1 shows the traditional layout of such rooms.

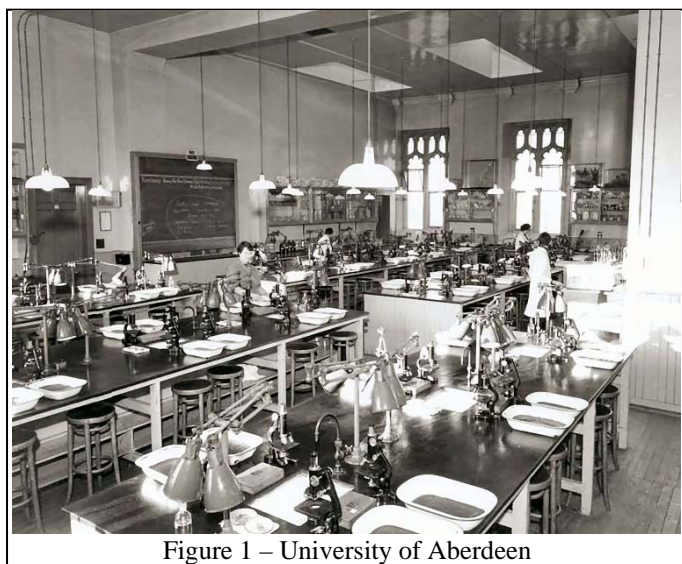


Figure 1 – University of Aberdeen

in Figure 1 shows the traditional layout of such rooms. The traditional benches and equipment are designed around the need for experimental work, itself a pedagogic and technological innovation in its day, but leave little flexibility for other pedagogic scenarios.

Figure 2 shows a similar laboratory a few years later. There are now television screens within the laboratory and the lighting is more modern, but from a pedagogic perspective the room has changed very little. When looking at figures 3 and 4, which are different views of the laboratory in figure 2, the difference is very marked.

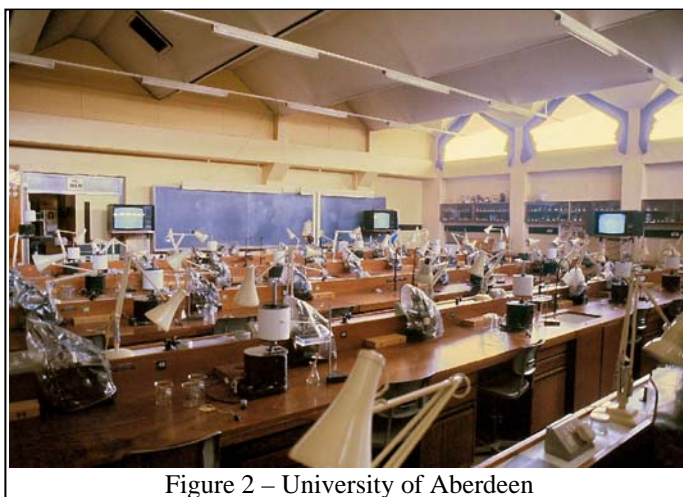


Figure 2 – University of Aberdeen



Figure 3 – University of Aberdeen

The first impression is the sense of space, although the capacity of the room has not been reduced. The white coats show that this is still an active wet-lab, but with computers being brought in alongside the experimental benches. The innovations here are simple and effective. Groups of up to twelve students work around 'island' benches, each with four computers. The monitors are on a raised shelf and the keyboards can be put on to the shelf below the monitor when not in use, or used on the bench. Figure 4 is taken from the centre of the room, with the other half being a mirror image, including a second projector. The use of learning technology is a truly embedded part of the learning and teaching, with a wide range of new pedagogic opportunities being added to the learning space.

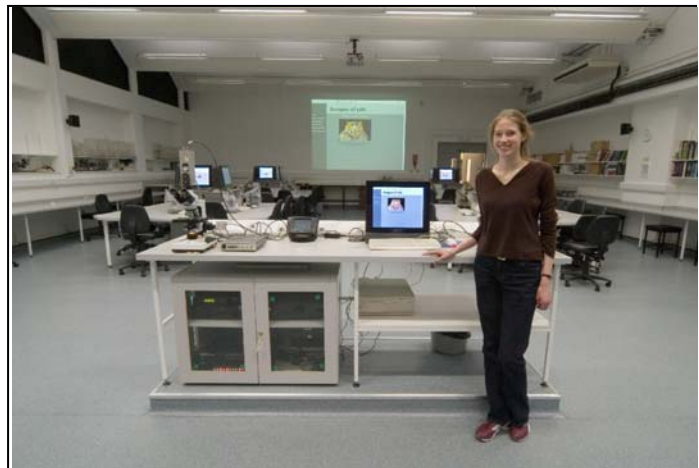


Figure 4 – University of Aberdeen



Figure 5 – University of Strathclyde

Figure 5 shows a familiar layout for a small seminar room. There are many positive features in this room; the furniture can be moved, there are multiple projection screens and a television. So this room does enable a variety of pedagogic approaches, which should not be lost when incorporating new technology, but it is not technologically-friendly - with a lack of power and data for students and no desktop computer for teaching use.



Figure 6 – University of Strathclyde

Figure 6 shows a similar room to that in figure 5, but in a more modern style. The aesthetic differences are evident, and should not be dismissed as merely cosmetic, but the real changes are in the new pedagogic opportunities that have been made available. There is now a lectern at the front, incorporating a modern desktop computer. This permanently fixed computer is linked to display equipment and the institutional network. There is a mixture of fixed and flexible seating, but perhaps most significant are the curved desks. These are

designed specifically to facilitate group working as an embedded part of the teaching session.

The example in figure 7 illustrates group working taking a central role within a teaching session. The desks within this teaching space can be used without computers, but the introduction of power and wireless data to the rooms means that, when appropriate, students can work individually or in groups on networked computers.



Figure 7 – University of Strathclyde

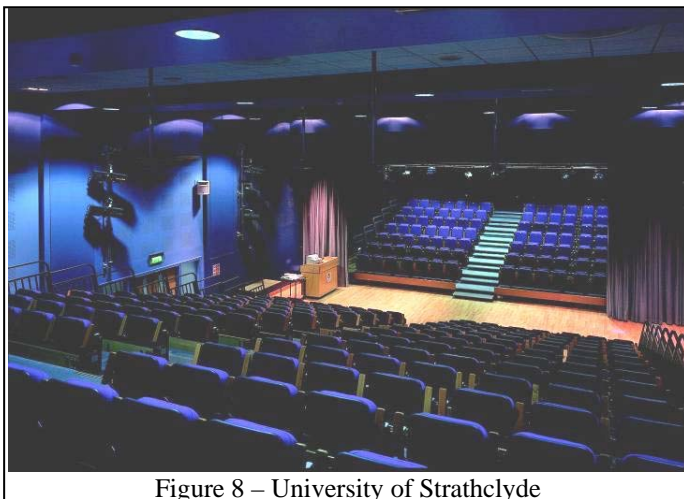


Figure 8 – University of Strathclyde

Larger teaching rooms allow scope for larger-scale innovation. Figure 8 shows a large lecture theatre set out in 'parliamentary' style. Sophisticated lighting and projection equipment is evident, but not immediately obvious is the fact that the tiered lecture seats are movable, meaning that this space can, in addition to its use for lecturing, be used for activities such as dance and drama. Furthermore this room can, when not needed for learning and teaching, be used as an exhibition space.



Figure 9 – University of Strathclyde

Figure 9 shows the same lecture theatre from the same angle, however the room has now been divided and the display configuration changed to give a more conventional lecture arrangement, but with multiple display screens. The multiple display screens can be used to give all learners an optimal view of the same display, or to display different items simultaneously.

Another important innovation in the use of teaching spaces is distributed teaching and learning. Distributed learning might be considered a form of distance learning, however a distributed session involves linking entire classrooms with individuals or other groups, hence some of the learners are learning at a distance others are not.

Figure 10 shows an example of a medium-sized teaching facility, which is equipped for video conferencing. This facility allows medium sized groups to be co-located but to be taught, or for the tutor to teach, remotely with another similar sized group.

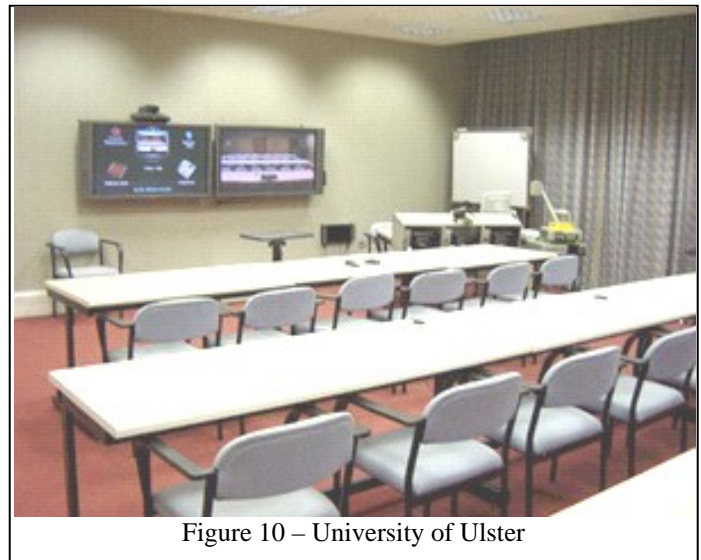


Figure 10 – University of Ulster



Figure 11 – University of Birmingham

Figure 11 shows another example of this in practice with a group of students working together, but located in Dublin and Birmingham.

A very strong trend, picked up from our survey as the single most likely type of new equipment to be installed within the next three years, is the use of audience responses systems.

Figure 12 shows a light-hearted example of a quiz question used in an orientation session for use of the equipment. These devices allow a tutor to display a set of questions and to get immediate responses from the audience, typically these would be to test comprehension or for other formative assessments. The responses can be anonymous or named, and can include levels of confidence. Taking 'audience participation' a step further, writing pads or panels can be made available to participants, allowing writing, drawing and annotation of displayed documents. With the right software this facility can operate with any handheld or laptop computer.

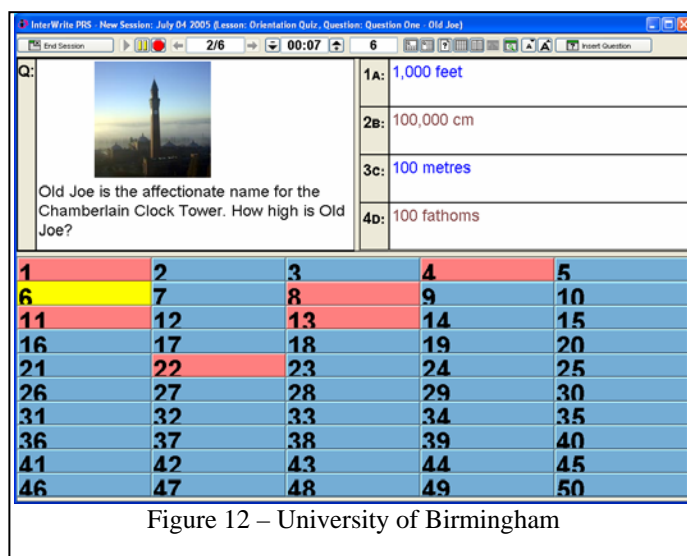


Figure 12 – University of Birmingham

Seeking to summarise what the study found with respect to teaching spaces; there are a few technologies that we can expect to see in most teaching space building and refurbishment projects over the next five years:

Display Equipment – Display equipment is still a very important part of teaching technology. That display equipment might be a data projector combined with a 'smartboard', a whiteboard with a camera or a document camera and data projector, but is of continuing importance in teaching rooms. Some developments are already taking place; plasma screens have become a viable alternative to data projectors in smaller rooms; display equipment is becoming more sophisticated with multiple projection systems and some three-dimensional systems coming on to the market.

Wired and Wireless Networking – to be fully exploited as devices for information and communication computers need network access. Wired networking still offers superior performance to wireless infrastructure, especially where computers are fixed and in high densities. Wireless networking is developing fast, but so is wired networking and so are the data needs of learners. So the 'rule of thumb' that seems to be developing is that where there are fixed computers they should be wired, where mobile computers are in use wireless access should be provided.

Electrical Power – The need for electrical power is still a weakness for mobile computing. Providing mains electrical power to individual places in large lecture theatres is expensive both in terms of capital and maintenance, yet without power, at least to small clusters of users, mobile computing will struggle to become fully embedded into learning and teaching. There are three trends which may help, at least partially, to address this problem. Firstly is the trend to reduce the power needs of computers, the net-powered computer [<http://news.bbc.co.uk/1/hi/technology/4494899.stm>] is a good example of this but still needs a physical cable. The second trend is the improvement in battery technology, the aspirational position being the use of fuel-cell technology [<http://news.bbc.co.uk/1/hi/technology/4434277.stm>] which could allow 40 hours or more of battery life. The third factor which may help is the potential for the use of induction loop power, such as is found commonly in electric toothbrushes. In this scenario a single, low voltage power supply could be made available without the need for mains wiring.

Flexible Furniture– The ability to reconfigure a teaching space, and the learners within it, is very important if we are to allow pedagogic flexibility. However, flexible furniture does not always mean moveable furniture. Fixed furniture can be designed to allow different working styles and different groupings of learners. Flexible furniture should also allow for the technology that may need to go with it.

Interactive Technology – consisting of:

Collaborative software – collaborative software allows users, with some sort of networking technology available to them, to share programs, diagrams, text and presentations with each other and with other learners and tutors participating in the same activity.

Video Conferencing – Video conferencing is often a native feature of collaborative software, and is an effective way for physically remote learners to speak and interact in a natural way.

Audience Response – Audience, or personal, response systems bring learners who would otherwise have had the opportunity to be passive into the centre of teaching activities. Audience response systems are teacher-led but involve the learner in a powerful and relevant way.

Document Cameras – There is a vast array of information that is available in digital format, but for the foreseeable future a significant proportion of information will not be readily available electronically. A document camera allows any text, drawing or other object to be displayed to large groups of learners with minimal preparation or as an ad-hoc response to learner needs.

Printers – In the same way that document cameras allow us to bring physical objects into the digital world, so printers allow us to bring digital objects into the physical world. The need to print is reducing, but at present that is at least counter-balanced by the increase in material available for printing.

Open Access Spaces

Open access spaces are, currently, one of the types of learning space that is being given most thought. The use of group work and supported self-study is rising sharply, and students need and expect facilities to be provided that help them to do this work. A recent survey [<http://news.bbc.co.uk/1/hi/education/4098608.stm>] showed that a supportive and 'friendly' atmosphere is the most important factor in student selection, and many of the universities selected for our site visits, were, without any prior knowledge of the survey, among the most highly rated by students. Efficient use of open access spaces improves the student experience and also helps to contribute to ensuring that very expensive estate is used to maximum advantage.



Figure 13 – University of Birmingham

Figures 13 and 14 show what can be done with a very traditional 'Current Periodicals Room.' During peak times there are always queues of students waiting to use this very popular facility, and even at 8am outside term time, as in figure 14, the room is still well used.

This room uses a pattern which was widely seen among the sites visited. The computers in this room are interspersed with empty desk space, to accommodate books papers and laptop computers.

Many of the people interviewed for the survey had considered whether or not to take this philosophy a step further and leave such spaces completely free of desktop computers, but instead provide wireless networking and plenty of power sockets. This would require students to bring their own laptops, which would need wireless capability. The study carried out at Eindhoven, by Lidgely and Roberts, shows that this can be done, but raises a wide range of issues which would need to be addressed at an institutional level. At present open access spaces with high availability of desktop computers are popular and well used. Students can bring their own laptops and use the wireless connection if they wish, but the evidence across the study shows that it is still pragmatically necessary to provide wired desktop computers in these spaces.



Figure 14 – University of Birmingham



Figure 15- York St. John College

Figure 15 shows another example of an open access area, computers in this area are available alongside comfortable seating, where students can sit and discuss their work. This space has incorporated electronic display equipment, in this case a plasma screen. This particular screen is, at this time, showing learners a list of alternative locations with computers currently available.

Figure 16 shows a similar area, with a mixture of casual seating, desktop computers and paper-based learning resources in the same areas.



Figure 16 – Harper Adams University College



Figure 17- University of Warwick

In figure 17 the display equipment in this open access building has pictures of the support staff on duty. These staff do not have a fixed support desk, instead they move around the learning space, offering a wide-range of help and advice to the learners.

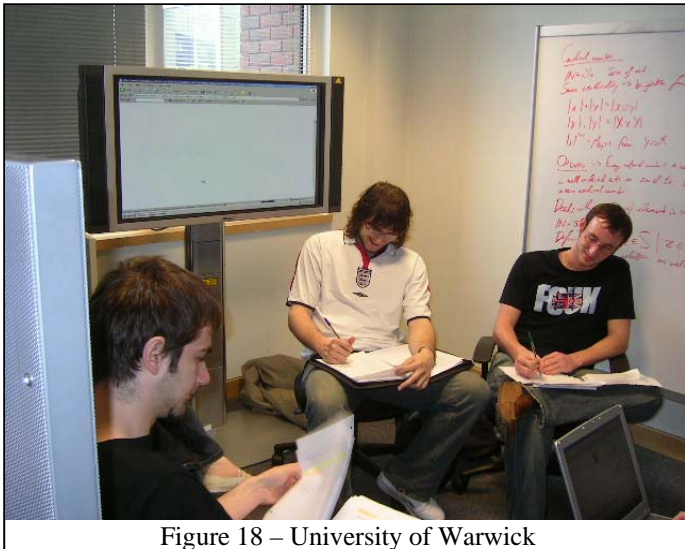


Figure 18 – University of Warwick

Figures 18 and 19 show examples of students working in small, self-directed, work groups. Figure 18 shows clearly the use of display equipment to facilitate and record collaborative work. In this particular building a wide range of working areas are available, and students are encouraged to use the space creatively and flexibly. Different types of display equipment and different types of seating are used to help different types of group activity, with the ability to share work with a group and to record group work being fundamental to support effective collaboration.

The flexibility of the furniture and the availability of moveable screens mean that students can create different working areas for different working scenarios.

An interesting feature of contemporary open-access spaces was the attitude to talking. For collaborative work to be taking place then talking, and even argument and debate, is a necessary part of the process. However there is still a need for quiet individual study. From the site visits the impression was that students could work very well in an area with a quiet background 'hum', and in fact found that more relaxing than total silence.

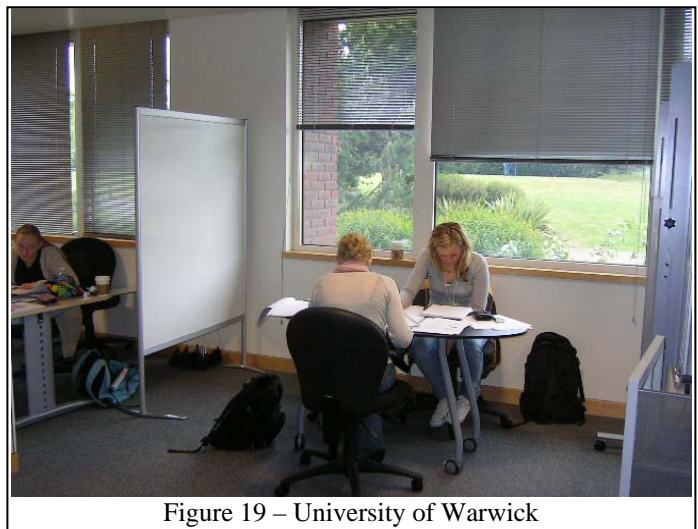


Figure 19 – University of Warwick



Figure 20 – York St. John College

Figures 20, 21 and 22 show three parts of a single open plan space. In each part the furniture is set out to encourage different styles of working. In figure 20 the style and layout of the furniture is designed to encourage open and casual conversation.

In figure 21 the arrangement of small tables is designed to encourage quiet, but not silent, work in small groups.

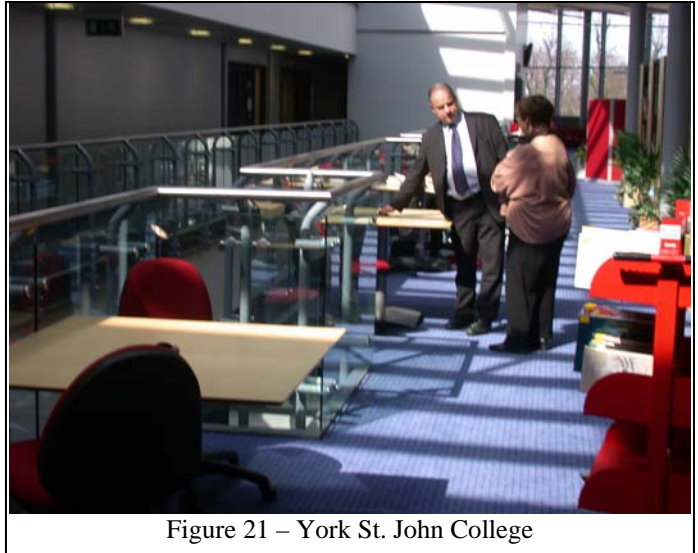


Figure 21 – York St. John College

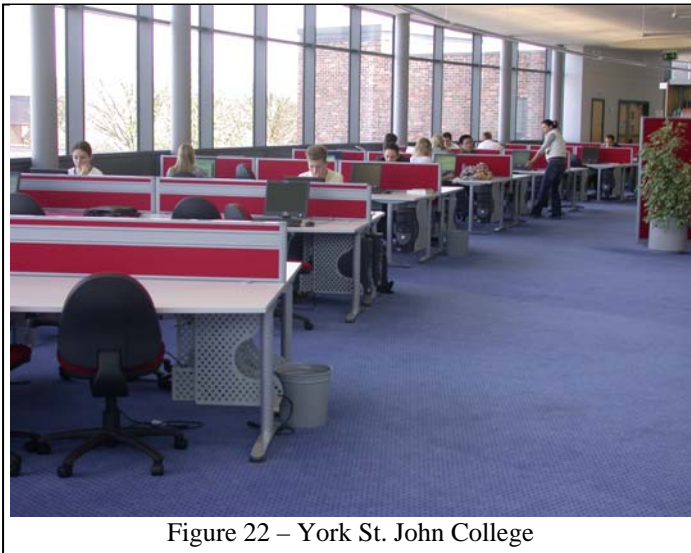


Figure 22 – York St. John College

The individual working spaces in figure 22 are designed to encourage silent, individual working.

This range of design approaches seems to work in a natural and intuitive way, with students selecting their working area in accordance with the type of work they intend to do at any given time.

Open access spaces are likely to become an increasingly important part of managed learning space. They will, by their very nature vary considerably. But there are a few key items that should be considered in the design of open access spaces. In common with teaching spaces they need wireless networking, access to collaborative software and plentiful access to power. Display equipment is needed, but will be smaller and more 'localised' than in a teaching space. Also in common with teaching spaces there needs to be flexibility in the furniture and provision for group working. Of particular importance in open-access spaces are the following:

Information display equipment – learners need to be able to get access to information that is useful and of direct interest to them. This might include announcements, opening hours, availability of support and availability of working space in other areas.

High specification desktop computers at each place with individual cameras, personal headsets and microphones – learners still need, in most cases, to be provided with desktop computers. With increasing use of multimedia headphones become important, and with increasing use of collaborative software so cameras and microphones become very important. Headsets do, of course, introduce management issues which will need to be considered in context.

Desktop computers with adjoining desk space for books, paper and mobile computing devices – it is still unusual for learners to be able to access all information on a single electronic device, so books and other electronic devices may be necessary. It may also be that the learner does have their own wireless mobile device and simply needs access to power and a desk.

Flexibly partitioned group working areas – this will allow learners to form groups as and when appropriate and of an appropriate size.

Social Spaces

Social spaces have long been recognised by universities as an important part of the learning process " an essential aspect of the teaching-learning process is in developing a conversational framework" [Diana Laurillard, Rethinking University Teaching]

Pedagogically social spaces serve to extend not only the learning times and learning spaces, but also the opportunities for informal 'conversational' learning. However, given the more relaxed approach to social activities, such as talking and discussion, in open access spaces, the question may be raised as to why we need to make use of social spaces and why they need to be seen as different from other open access spaces. The first thing to recognise is that the distinction is certainly becoming more blurred, and may well break down further in the future, but for the present there is a difference. Social spaces are designed primarily for socialising and relaxation, open access spaces are designed primarily for working. However, it can bring pedagogic benefits to be able to combine the two. Operationally it is also an opportunity to make more efficient use of space. Student computer ratios can be improved as can social facilities without the need for expensive new buildings.

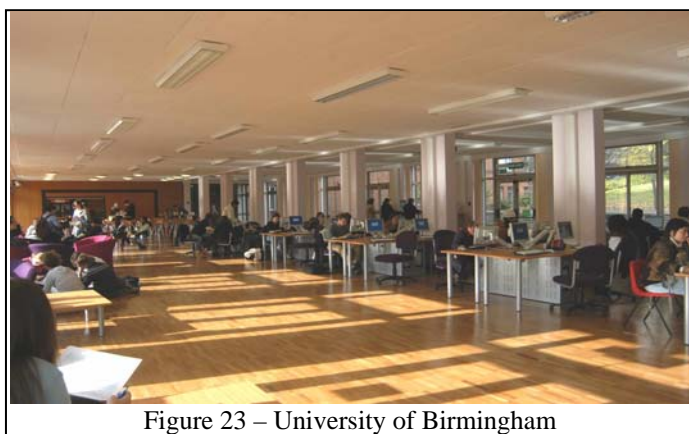


Figure 23 – University of Birmingham

Figures 23 and 24 show different views of a 'junior common room' that has been converted into a technologically-rich social space. The space incorporates a range of seating styles, both with and without computers. At one end is a café, where students can buy drinks and snacks, to one side are standing places for quick use of equipment and at the other end is a range of tables with desktop computers. This facility is very popular with students, having

enhanced both the social and working facilities available to them, and provides an effective bridge between a working and a social environment

This approach to learning spaces design was very popular among the sites visited, as it seemed to provide an '*easy win*' for students, teaching staff and administrative staff, by simultaneously improving social facilities, learning facilities and improving utilisation of space.

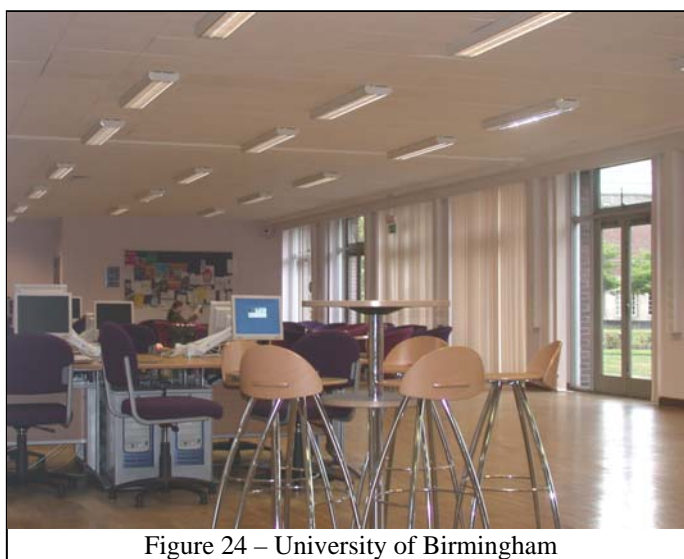


Figure 24 – University of Birmingham



Figure 25 – Glasgow Caledonian University

Figures 25 and 26 show different views of the same social space; created as part of major refurbishment project. Based on the clear pedagogic vision that ‘all learning starts with conversation’, these projects have created a friendly and inviting working environment that is highly student-centred.



Figure 26 – Glasgow Caledonian University

Bringing technology into social spaces does not always need major refurbishment projects.



Figure 27 – University of Birmingham

Figure 27 shows that social and leisure space, such as this entrance and reception lobby, can be transformed into a learning space by making wireless networking available.

Figure 28 shows an outside area covered by a wireless network, when weather permits the outside area can become a natural extension to working areas.

Widespread use of wireless networking means that any appropriately equipped mobile device, such as a laptop, tablet or handheld computer, can be used to access online information and services.



Figure 28 – University of Birmingham

In summary social spaces need the same facilities as open access spaces, but with the addition of drinks and snacks. It is also important to maintain the genuinely social aspects, so some areas may have little or no learning technology.

It is perhaps also important to remember at this point that this study has classified some spaces as open access and some as social. Adding learning technology into social spaces does create de facto open access learning spaces, and the transformation can also occur in the other direction. Providing social facilities, typically snacks and drinks, in an open-access learning space will make that space into a social space. So the trend to increasingly manage the technological provision within social spaces is facilitating a greater fusion between learning and socialising.

Other Learning Spaces

Post-16 educational institutions are willing and able to manage the provision of learning technologies within the boundaries of the campus, however availability of Internet access and therefore online services is extending far out into the wider community.

Student accommodation is perhaps the first area to which we would expect online services to be extended, and indeed this is now widespread practice. This can be outsourced to a specialist provider or can be covered by institutions themselves. However students living on-campus at, or near, their place of learning are not the majority in post-16 education, many students study, either full or part-time, while living at home. Home Internet access, particularly un-metered broadband, is still on the increase. In the fourth quarter of 2004, 52% of households had some form of Internet access [Office of National Statistics - <http://www.statistics.gov.uk/CCI/nugget.asp?ID=8&Pos=1&ColRank=1&Rank=192>].

So broadband in the home is now commonplace and is continuing to spread. Effectively this extends the potential for learning into the home. Home learning is not necessarily a part of distance learning, it may be a natural extension to classroom learning, with activities supporting and building upon the activities initiated as part of a formal teaching session. Asynchronous communication, such as email and discussion boards, can also help to bring together people who would otherwise be out of communication for long periods of time.

Out of the home high speed internet access is also growing. Cardiff city centre now has extensive wireless network, coverage as does Stratford-upon-Avon where wirelessly enabled handheld computers can be hired as tourist guides. In the case of Cardiff the wireless networking has been extended into St John's Church at the instigation of the local rector [http://news.bbc.co.uk/1/hi/wales/south_east/4594989.stm].

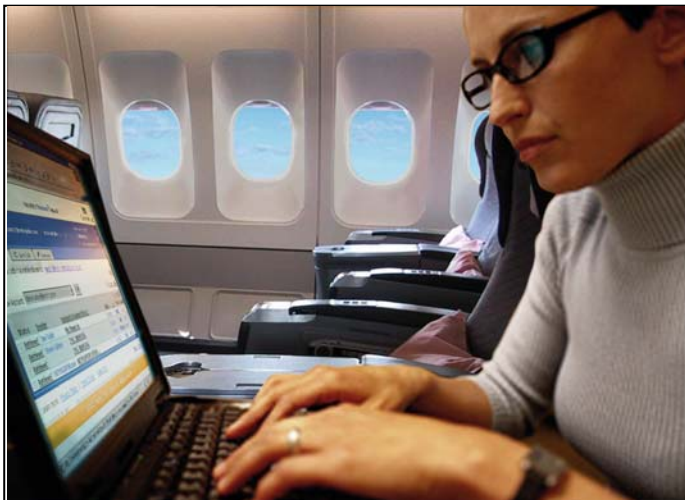


Figure 29 – Courtesy of Verizon Airfone

Broadband has also now been extended into planes, see figure 29, trains such as the Thalys European trans-continental train offering 4Mbps at 300 km/h [<http://telecom.esa.int/telecom/www/object/index.cfm?fobjectid=18364>], and even into a mobile classroom [Hysbys: <http://www.hysbys.org>].

Learning Resource Centres

So far the study has categorised the learning spaces for ease of analysis, however categorising spaces does not mean that they are necessarily separated. There are two possible models when locating learning spaces; one model is to locate the learning spaces within the academic departments, the other is to 'centralise' the learning space into one or more learning centres. Both models have their advantages and disadvantages, and most institutions had a blend of the two approaches.

The site visits have shown that providing appropriate learning spaces and ensuring that they are technologically fit for purpose is only a part of the overall picture. The way in which the learning spaces are located, configured and supported is very important, and will impact considerably on the learning and teaching that can take place.

Many institutions have responded to this challenge with the creation of learning resource centres, such as these ones in figures 30 and 31. Within these buildings students can access a full range of learning spaces and learning support services. This gives us the concept of a 'Learning Mall' (see Visions of the Future) where a student can take out a book, replace their identity card or get access to student welfare services, all from the same service desk.



Figure 30 – Harper Adams University College



Figure 31 – University of Hertfordshire

This single point of access for students creates far greater transparency, and reinforces the approach that “students should not have to know how the university’s departments are structured in order to get access to the services they require” [Senior member of staff, Glasgow Caledonian University].

Figure 32 shows us an artist's impression of one learning mall currently under construction.



Figure 32 – Doncaster College



Figure 33- Glasgow Caledonian University

Complete new buildings, as in figure 32, or major rebuilding projects as in figure 33 do provide opportunities to create such facilities, but the essence of the learning mall is about transparent access to services and facilities - which it may also be possible to provide within existing estate.

It is also important to consider the technical support that such transparency requires. Responding to user needs via a single service desk means that the service desk must have access to all the necessary information, and be able to change and update information as appropriate. This may require some planning and enhancements of management information systems within the institution, but will made a substantial difference to learners' experiences.

Vision of the Future

Learnwell College of Further and Higher Education

Learnwell College gives every member of staff a tablet computer and all students a personal digital assistant (PDA). When staff and students arrive on campus they are automatically connected to the network. Upon connection they are registered as present and files such as learning resources, timetables and learning tasks are automatically updated and integrated into their learning software, so staff and students have all the resources they need at their fingertips for the activities for the day. The college provides a number of Wimax (long-range wireless network – <http://en.wikipedia.org/wiki/Wimax>) points, meaning that members of the college can access the college network from city centre shops and cafés, libraries and in places of work. This way staff and students are always online and all their files and other information can be kept up-to-date.

The electronic 'one-stop-shop' of resources on the students' PDAs – http://en.wikipedia.org/wiki/Personal_digital_assistant is reflected in the design of the college's main building 'The Learning Mall'. In this building, students have access to a wide range of learning resources and support, ranging from IT support, such as solving problems in the use of their PDAs, to accessing student finance and welfare services. The Learning Mall was built to be flexible, with soundproof 'dividers' that can be moved when required. The focus of the Learning Mall is on providing students with a wide range of learning environments, such as resource centres, Internet cafés, self study booths and large rooms where groups of students can engage in a range of activities and, of course, teaching rooms. All the rooms are supported by a wide range of learning technologies. Working with their tutor or learning facilitator, students can design learning activities to support their programmes of study and then book the appropriate learning space.

The latest generation of PDAs and tablet computers have become sufficiently energy efficient and to be powered while connected to the network or by induction loops in desks. The fuel cells that now power their laptops are good, with around 100 hours of battery time, but still not as good as their mobile phones used to be back at the turn of the millennium. The Learning Mall has high-bandwidth wired networks alongside wireless networking, to support the wide range of devices that people are using. All the social places and learning areas are linked together with video and audio conferencing and staff and students can 'connect' their computers to large plasma screens when they need to demonstrate aspects of their work to others.

The tutor/facilitator

Emma is a tutor. A typical day for her will begin with using a tablet computer to check that all the students are where they are supposed to be, and doing what they are supposed to be doing. She cross-checks the students with the learning activities that she has set them, and logs on to the room they are in. Emma quickly checks her appearance on her own computer, before sending the image to the learning room. As she says "Hello" her students rush to turn down the speaker volume to a more comfortable level, the last person must have left it on too high. Now with less amplification Emma says "Hello" again and asks how things are going. John gives her access to his PDA to explain a problem they are having and she transfers it to the plasma screen to go through it together. This takes only five minutes. At 10am she has a group of students that have asked her to run a workshop and they have booked a room in the Learning Mall. There are 15 students in the workshop. They use interactive pads with their PDAs, and have also arranged to link up with the other students from another college to help them complete their tasks. During the workshop,

students record the main points of their activities into their learning logs on their PDAs. These are then downloaded automatically to the 'National Learning Grid' where each student's learning log is kept for as long as they need it.

At midday, Emma has arranged to video-conference with eight part time students. These students are unable to come onto the campus for this meeting, so Emma uses the collaborative software on her tablet computer, which is now linked to a plasma screen in her office. The broadband connections into the students' homes are provided as part of the college's wide area network, so there is no additional cost to the students. For lunch, Emma joins her colleague Sally in the Learning Mall in the technology free zone. Sally is the supervisor in the motor vehicle workshop and she brings Emma up to date on the learning technologies she is using to support her students learning activities. For the afternoon, Emma is officially 'off-line' as she has put this time aside to prepare a range of learning activities for a new course she will be running next year. From her office she links up with Bernard, who works in a similar institution in France. Bernard and Emma will be running the course on-line linking up both institutions. At the end of the day she checks her learning software and she sees that the students that were preparing for the seminar have uploaded the resources they will be using, she checks them and is very pleased with the work they have done.

Learning Mall Service Desk Manager

David manages the service desk in the Learning Mall. Using the management interface to the learning environment, he is able to access the wide range of services that students require. Today he is going to work on the main desk for a couple of hours, as it is the start of a new term and lots of students need help in finding their way around. One or two students have had difficulty with self-registration; they have been unable to get their ID cards from the automated dispenser - even with the online support. David logs into the learning environment and sees that one large local employer appears to have not paid its fees. David manages to solve the problem and students are able to get their ID cards. A few students are also having problems with their accommodation, David uses the student accommodation system and finds that their accommodation had to be changed at the last minute, he is able to sort out their problems. One or two students have some concerns about how they are going to manage their full-time study and David is able to book them sessions with the welfare service, that same day in the adjoining 'consulting booths.' Some of David's staff 'patrol' the Learning Mall with PDAs that have hands free headsets. These staff provide a wide range of support and are clearly identified by their bright blue uniforms. All enquires are logged and continually monitored so that support systems can be continually updated to provide a high quality service. At the end of David's shift he hands over to the evening manager, who will work until 10pm. As the evening goes on things do get quieter, but the building remains open all night.

References and Further Reading

BBC – <http://www.bbc.co.uk>

Fuel-cell technology - <http://news.bbc.co.uk/1/hi/technology/4434277.stm>

Net-powered computers - <http://news.bbc.co.uk/1/hi/technology/4494899.stm>

St John's Church, Cardiff [http://news.bbc.co.uk/1/hi/wales/south_east/4594989.stm]

Students 'want friendly campuses' - <http://news.bbc.co.uk/1/hi/education/4098608.stm>

European Space Agency – <http://www.esa.int>

Thalys European Train - <http://telecom.esa.int/telecom/www/object/index.cfm?fobjectid=18364>

Institute of Electronic and Electrical Engineers (IEEE) – <http://www.ieee.com>

IEEE Standards -

http://www.staff.ncl.ac.uk/i.g.clark/async/coherent/publications/ACD_bluetooth_stpetersberg_5-2002.pdf

Intel – <http://www.intel.com>

Moore's Law - <http://www.intel.com/research/silicon/mooreslaw.htm>

Internet 2 – <http://www.internet2.edu>

History of Video Conferencing - <http://www.internet2.edu/presentations/20010308-I2MM-GettingStartedEndUsersDetails.PDF>

University of Wales, Bangor – <http://www.bangor.ac.uk>

Hysbys Mobile Classroom - <http://www.hysbys.org>].

Wikipedia – <http://www.wikipedia.org>

PDA – http://en.wikipedia.org/wiki/Personal_digital_assistant

Wimax - <http://en.wikipedia.org/wiki/Wimax>