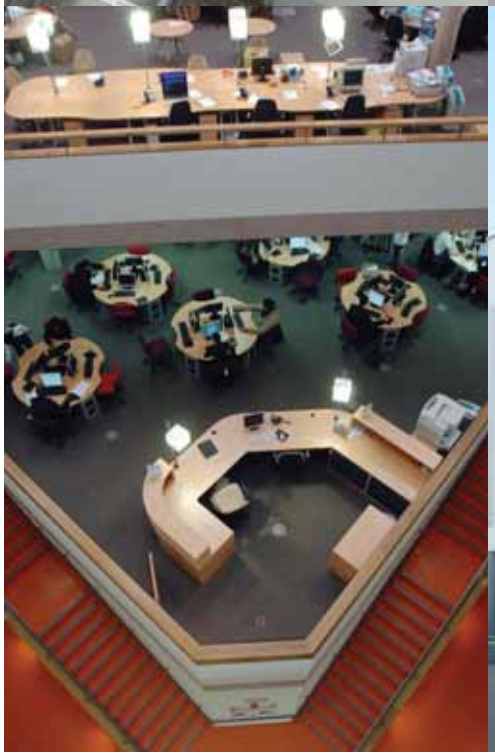
JISC

Designing Spaces for Effective Learning

A guide to 21st century learning space design



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Introduction

Learning is changing in the 21st century. Technologies used in learning, such as interactive whiteboards, personal learning environments, wireless networks and mobile devices, plus the internet and high-quality digital learning resources – and the ability to access many of these from home and the workplace – are altering the experiences and aspirations of learners.

Increasing investment in estate and learning technologies, combined with the need for more cost-effective space utilisation, is making it increasingly important for senior managers and decision-makers to keep abreast of new thinking about the design of technology-rich learning spaces.

Understanding what makes an effective design is important. The best are likely to assist all within the institution to work more productively and to produce learners who are confident, adaptable, independent and inspired to learn. In short the design of our learning spaces should become a physical representation of the institution's vision and strategy for learning – responsive, inclusive, and supportive of attainment by all.

Designing 21st century learning

An educational building is an expensive long-term resource.
The design of its individual spaces needs to 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

A learning space should be able to motivate learners and promote learning as an activity, support collaborative as well as formal practice, provide a personalised and inclusive environment, and be flexible in the face of changing needs. The part technology plays in achieving these aims is the focus of this guide.

Motivation

Well-designed learning spaces have a motivational effect. Learning areas infused with natural light, for example, provide an environment that is easy and pleasurable to work in. Wireless connectivity within a brightly lit atrium, learning café or open-plan social area will encourage engagement in learning, and instil a desire to continue activities beyond timetabled classes.

Involving learners in aspects of the design is important. This signals that they can have a measure of control over the learning environment and over their own learning. The Stevenage Centre at North Hertfordshire College, for example, has introduced digital local radio transmissions in learning zones within the internet café at the request of students accustomed to working with background sound.

Collaboration

Learners have been shown to benefit academically from social interaction with their peers. Open-plan informal learning areas provide individualised learning environments which also support collaborative activities, and they can often be created from previously underutilised spaces. An example is the internet café. In many institutions, entrance spaces now include open-access IT areas with refreshments and informal seating. Utilisation data have proved the worth of such areas – their value lies in the way they encourage learning through dialogue, problem solving and information sharing in the most supportive of contexts.

Personalisation and inclusion

Barriers surrounding the use of IT are being re-assessed and priority given to enabling, rather than controlling, access to learning. Technology-enabled learning will not be achieved without cost. However, institutions in all parts of the sector are exploring the use of password-enabled wireless local area networks (WLANs), laptop loan schemes and 24/7 access to digital resources in technology-rich learning centres and through virtual learning environments (VLEs).

Another significant trend is to adopt a more customer-focused and permissive approach, backed up by learning space design that encourages self-regulation. Greater maturity among IT users has been promoted by integrating IT into day-to-day activities, installing bookable and open-access computers in previously underutilised locations along circulation routes and in social areas, for example. Learning and information sharing then become seen as an integral part of everyday life.

Flexible furniture and wider doorways meet the needs of a variety of learners, not only wheelchair users. Audiovisual cues and changes in furniture layout can assist learners' navigation around a building, and help them to adjust their behaviour according to the purpose of the space. These represent shifts in attitude that welcome and support all types of learners and promote different ways of learning.

Flexibility

Following two decades of rapid technological change and increasing student numbers, flexibility in the design of learning spaces has become essential. Technologies that are as far as possible mobile and wireless will support a wider variety of pedagogic approaches, and make those spaces more easily re-purposed. But the ultimate in flexibility – large open-plan centres in which both learning and teaching take place – still presents challenges in management of sound, heat and student activity, and a mix of formal and informal learning spaces is still more frequently chosen.

"Organisations all face pressure to deliver higher standards of education, to greater numbers of students, with tight financial restrictions, but still need to provide facilities that will attract students in a competitive market."

JISC eSpaces Study, University of Birmingham (2005)

The Learning Café

The Learning Café at Glasgow Caledonian University was an early experiment in the use of space to support problem-based learning and group work. The café opened four years ago, and its success as a learning space is clear from student evaluations.

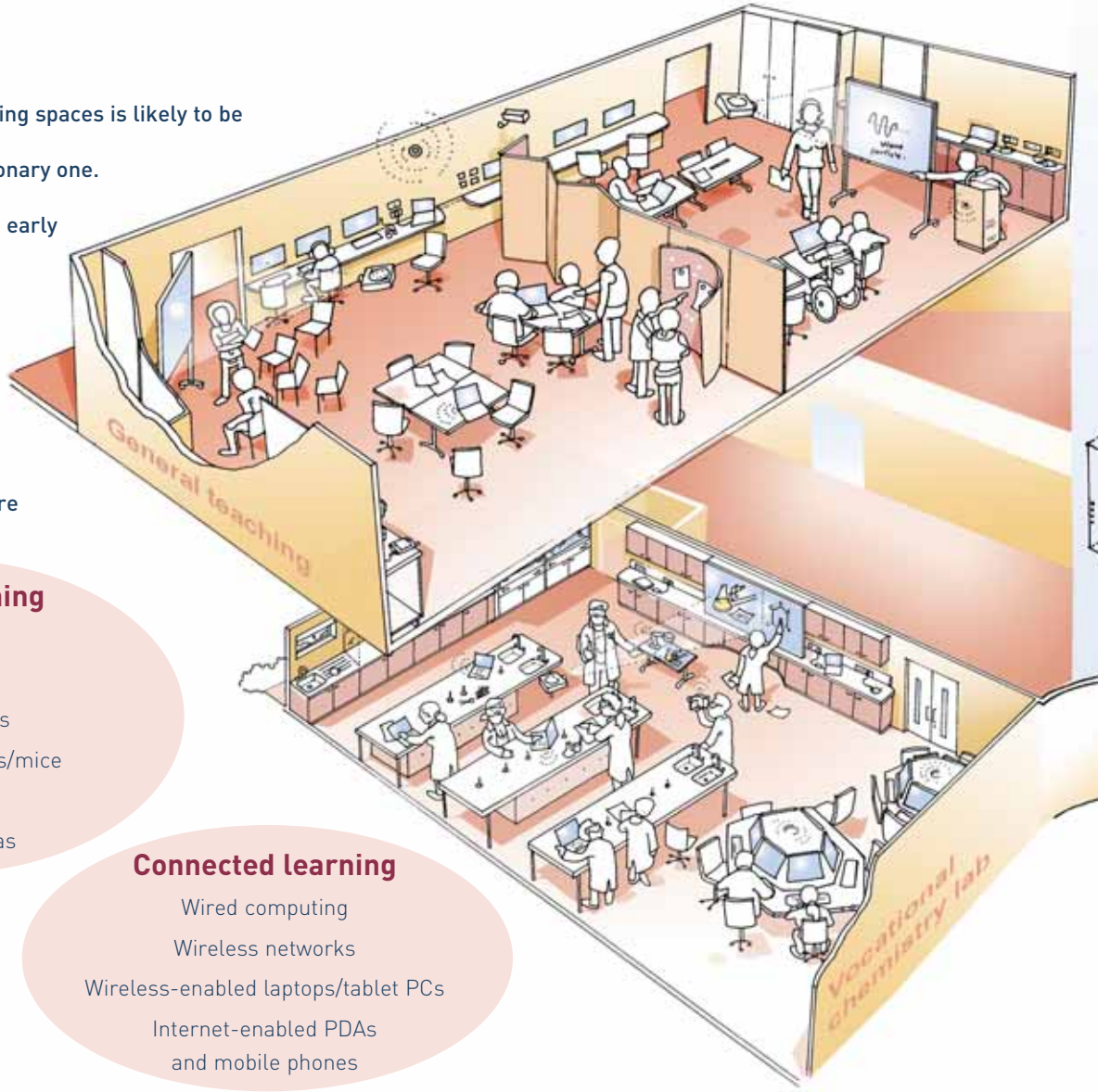
The deliberate mix of refreshments, social activities and IT makes this a relaxing and friendly place where conversation and social interaction are seen as an essential part of learning. Sixty open-access flat-screen terminals stand back to back for group study in the centre of the café, and on bars around the edges for individual study, while laptops on a number of low-level coffee tables encourage informal discussion alongside access to IT.

A welcome page on the café website encourages users to explore their learning preferences and time-management skills over a cup of coffee, and links to mind-mapping software introduce an essential tool for learning support. Thin-client technology keeps background noise and heat from computer drives to a minimum.

Learning cafés are now running successfully in many institutions, proving fears over IT-based informal learning environments unfounded. The Learning Café at Glasgow Caledonian has also proved financially successful as profits are ploughed back to cover the maintenance costs.

Transforming learning experiences

Embedding technology into learning and teaching spaces is likely to be an evolutionary process rather than a revolutionary one. Considering technological requirements at the early stages of planning will ensure that maximum benefit can be obtained from the investment. Start by establishing your pedagogic aims, then review the design and the technological infrastructure in the whole institution, to ensure that your aims can be achieved.



Mobile learning

Tablet PCs

Laptops

Mobile phones

Wireless keyboards/mice

PDAs

Digital cameras

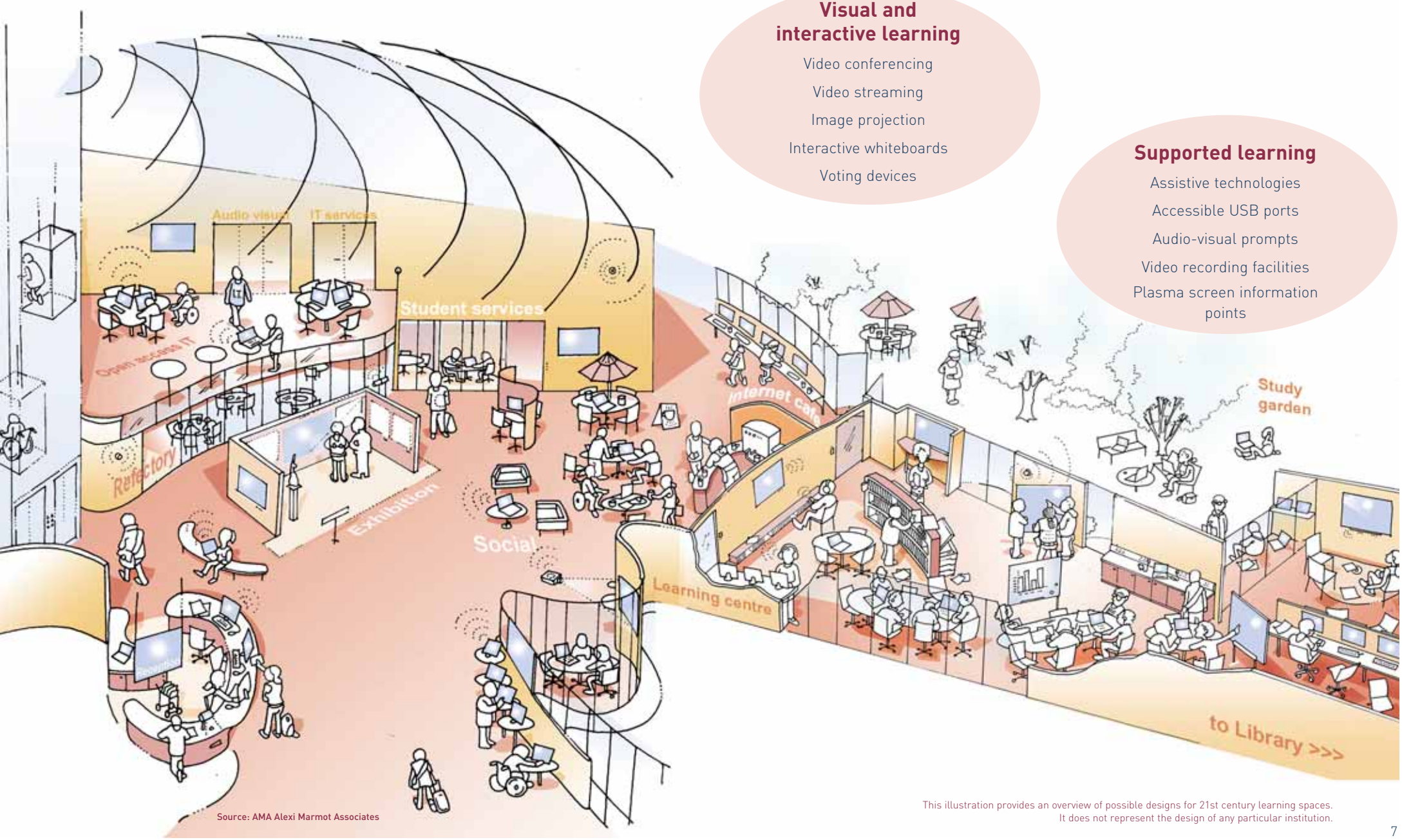
Connected learning

Wired computing

Wireless networks

Wireless-enabled laptops/tablet PCs

Internet-enabled PDAs and mobile phones



Visual and interactive learning

Video conferencing

Video streaming

Image projection

Interactive whiteboards

Voting devices

Supported learning

Assistive technologies

Accessible USB ports

Audio-visual prompts

Video recording facilities

Plasma screen information points

Source: AMA Alexi Marmot Associates

This illustration provides an overview of possible designs for 21st century learning spaces.
It does not represent the design of any particular institution.

Entrances

Entering a college or university building should create a sense of excitement about learning. The entrance is the first point of contact between the institution and its clients and will establish the prevailing culture for visitors. Its next priority is to offer clear, accessible information about the institution and what can be achieved there. An entrance area will also need to provide a welcoming, secure environment, establishing the capability of the institution to cater for its learners – after all, it has to compete for learners' time and attention with the shopping mall, the leisure centre, and facilities and technologies within the home.

Reception

The entrance to a college or university building has, in effect, an important and multifunctional role, yet so often is little more than an uninspiring space containing a reception desk managed by overstretched and isolated frontline staff.

Imagine something different...

Touch-panel information screens close to the entrance provide institutional and course information for potential students, and floor plans and promotional video displays for visitors. Audio versions are also available. A wireless-enabled interview area to one side offers potential learners more in-depth analysis of their needs, with trained enrolment staff accessing course information from tablet PCs.

Learners arriving at the start of the day pick up the day's timetable and room changes from plasma screens in a prominent position near the entrance to the learning cafe. They may also have received notification of changes via text messages to their mobiles. One large plasma screen overlooking the entrance reminds learners of key events in the institution's calendar or activities for the day. These multiple routes to information ensure a variety of needs are met.

Security is attended to – CCTV cameras are in evidence and card access into the building may be required in some instances – but a proactive service-delivery culture ensures that reception staff respond helpfully to the needs of visitors, assisted by a range of information outlets. The ambiance is calm and authoritative. Brightly lit, spacious and architecturally impressive, the entrance area inspires interest and respect.

Services

Learners passing through this space can access services such as counselling, careers, academic or financial advice, or even shop for essentials, as they enter or leave the building. Wireless connectivity and varied arrangements of furniture provide flexible interview areas. Zoned use of audio outputs means that local digital radio or music can be heard in some parts of the entrance and reception, providing travel information and a calming effect on those passing through.

Multi-purpose

A wider entrance area or atrium can provide space for displays of learners' achievements in a variety of media, including broadcast media. Its public nature and architectural and acoustic features provide an ideal backdrop to events relating to performing arts, music, media studies and fine art courses in the institution, and a forum for celebrations in the annual calendar – open days, awards ceremonies and end of term events – particularly if a larger conference or lecture hall opens out behind it.

The role of the entrance is vital. If it is little more than an imposing portal to the institution, or a spacious circulation route through to other parts of the institution, then opportunities have been lost. It can form the heart of the institution, and establish a culture of learning, support and professionalism, which reflects the institution's vision. It can bring together in one space the range of facilities on which learners depend, and demonstrate effective use of up-to-date communication and information technologies.

The Stevenage Centre, North Hertfordshire College

This state-of-the-art building completed in 2003 has a strong learner focus. Within the curve of a wave-shaped external frontage, the entrance, known as the Atrium, contains an internet café, a display area for students' work, a central reception area and meeting booths for careers advice and guidance. A relatively small-scale wireless network supports use of mobile computing equipment for staff and learners. The design promotes access for all, and is highly flexible – based around a central core, it can be altered to support different kinds of activity.

Promoting a culture of respect and independence has been key to the management of this space. Password-enabled access to gaming is being trialled at lunchtimes and in twilight hours, as is the zoned use of background music. The presence of computers so close to the entrance is justified by the powerful statement this makes about the pervasiveness of learning. Management is security conscious, but aims to prevent this becoming a barrier to learning.

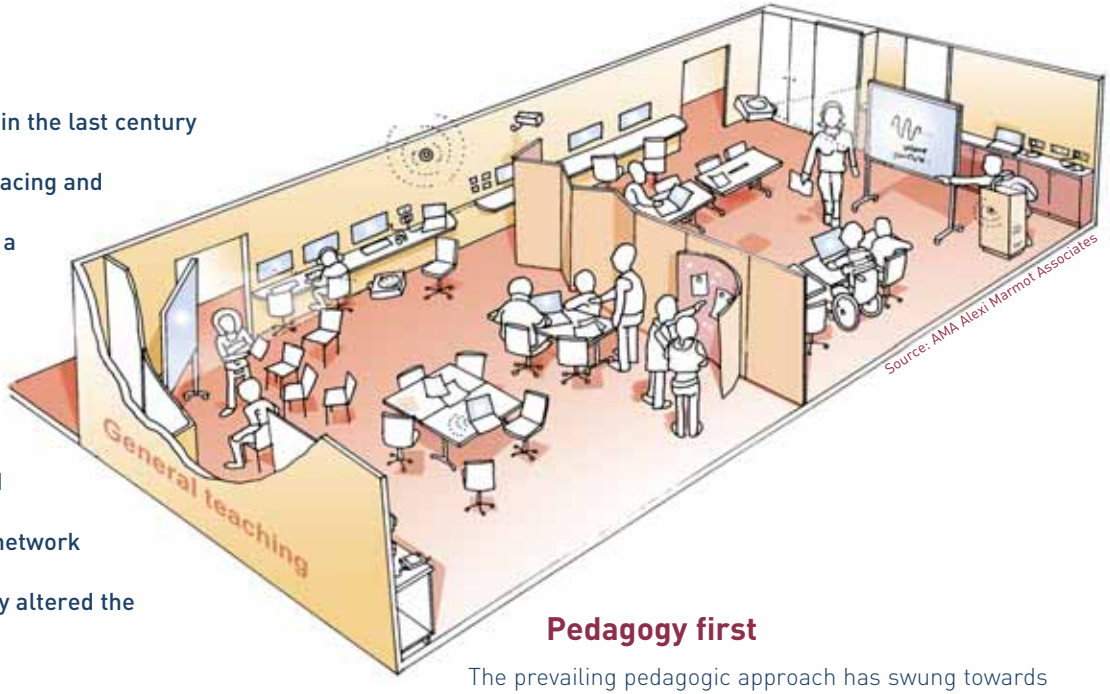
The mix of learners and staff working within the Atrium establishes it as a purposeful meeting place, designed to encourage and support learning.

"I believe passionately that when you walk through the door of a place of learning, you should feel proud, uplifted, motivated. ...That should be our intent."

Mark Haysom, Chief Executive of the Learning and Skills Council (LSC)

Teaching spaces

General teaching spaces have been dominated in the last century by one type of design: tutor-focused, one-way facing and presentational, with seating arranged in either a U shape or in straight rows. Technologies have subsequently been added – interactive or conventional whiteboards mounted on the wall behind the main speaker, ceiling-mounted projectors with cabling to a laptop, a wireless network and/or wired computers – but these have rarely altered the dynamics of the design.



Source: AMA Alexi Marmot Associates

Pedagogy first

The prevailing pedagogic approach has swung towards active and collaborative learning, but room design and staff skills sets do not always reflect this.

To resolve what is the best way forward for the institution, effective dialogues are needed to establish what will be required from the spaces, what changes in pedagogic approach are desirable, and why. Investment in developing the skills of staff also needs to be matched by fostering their ownership of the proposed changes. Visits by staff to other institutions have proved beneficial in supporting change.

The design of most general teaching spaces will usually need to support both tutor-led and learner-led activities. These will include presentations, discussion, collaborative project work, and information

retrieval and sharing. These needs have been met in different ways, with separate rooms being allocated to different purposes in some models and, at the other end of the spectrum, teaching taking place in open-plan flexible learning centres. What is essential, whatever the choices made, is that the adopted design is influenced more by clearly defined pedagogic goals, articulated by both managers and staff, rather than by other considerations, such as a desire for innovation or efficiency gains.

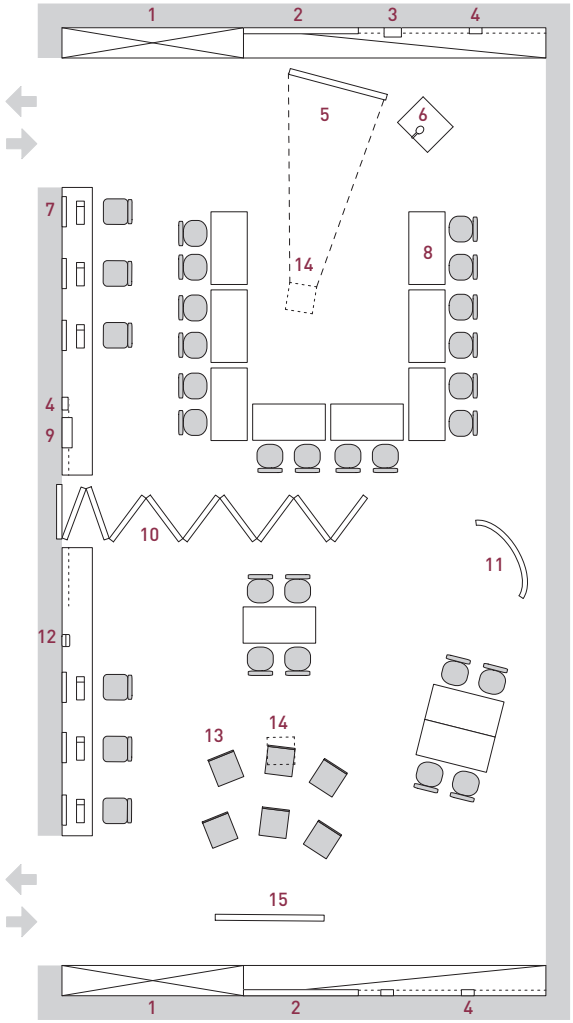
Future-proofing

We cannot anticipate future technological or pedagogic developments, but can ensure that designs will accommodate change. Investment in higher specification mobile rather than fixed technologies, wireless as well as wired networks, even bespoke furniture, may be justified when the space can support a range of purposes, and be relatively easily reconfigured. It is also probable that institutions will aim increasingly for fewer but better quality teaching spaces, with increased space per seat: large group or dispersed group teaching is already being supported by video streaming and video conferencing. Cameras in teaching spaces can offer that flexibility.

Tools fit for purpose

Use of technology in itself does not ensure effective teaching or learning, but it can extend the reach and flexibility of what the institution offers. Display technologies are now widely available in teaching spaces. The next significant development may come from audiovisual technologies. Wireless networks also provide significant advantages. 21st century institutions need to assess rapidly and accurately how effective courses are. Giving tutors wireless-enabled tablet PCs for e-registration can ensure attendance data is fed immediately into central records, provide the tutor on the move with a tool for preparation, and give both learners and tutors access to resources during the session – from any part of the space.

General teaching spaces



Raised floor and ample perimeter cabling for easy access to power and data points.

1 Lockable storage and recharging facility for wireless tablet PCs
2 Whiteboard
3 Receiver for voting devices
4 Power sockets
5 Mobile interactive whiteboard
6 Lectern with control panel for lighting and power/network points
7 Wired computers
8 Foldaway tables
9 Charger for voting devices
10 Folding/sliding acoustic wall
11 Free-standing magnetic surface/ partition
12 Wireless hub
13 Stackable chairs
14 Ceiling-mounted projection
15 Video conferencing facility

This floor plan gives prototype designs for two teaching spaces. It does not represent designs in any particular institution.
Source: AMA Alexi Marmot Associates

University of Strathclyde

The InterActive ClassRoom

Changes in teaching style in the Department of Mechanical Engineering at the University of Strathclyde in the 1990s were prompted by low achievement and attendance among first year students. The department turned to a version of the Socratic dialogue model, or teaching by questioning, developed at Harvard University, in a bid to re-engage its students. The standard combination of tutorials, lectures and workshops was replaced by a series of two-hour active learning sessions, involving mini-lectures, videos, demonstrations and problem solving. Questioning and discussion replaced knowledge transfer as the main model of delivery, and a custom-built lecture theatre – the InterActive ClassRoom – was created from existing teaching accommodation in the James Weir Building to support this approach. An electronic voting system was introduced to help students test their understanding of concepts in response to multiple choice questions, and collaborative discussion before and after voting became established as an integral pedagogic approach.

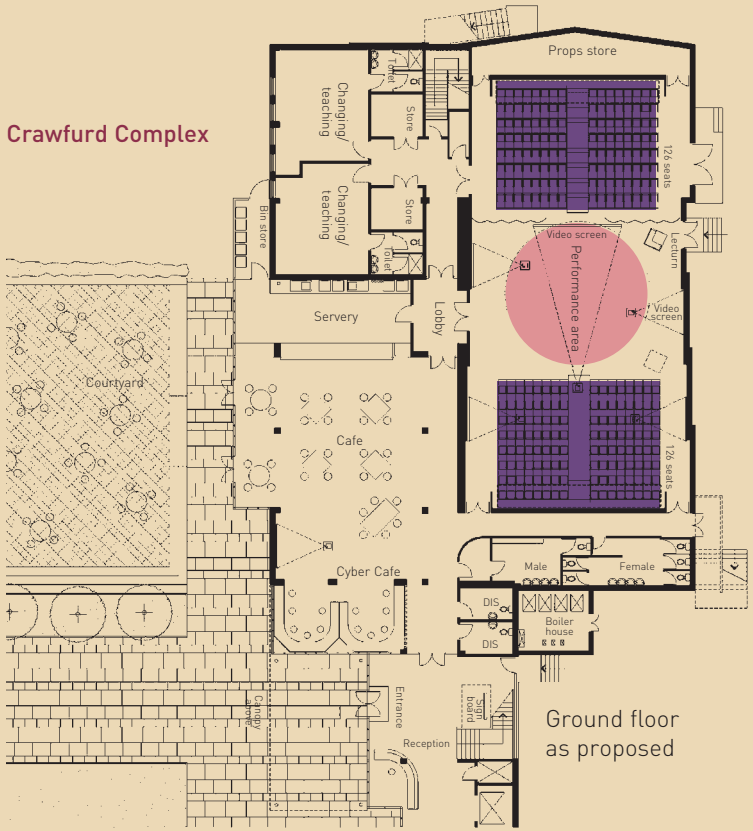
The Teaching Cluster

In 2000, the first Teaching Cluster at Strathclyde evolved out of the success of the initiative. This is a centrally managed suite of teaching rooms that includes an interactive classroom, seminar rooms and a teaching studio, providing a mix of peer instruction, problem-based learning and studio teaching. To gain maximum benefit from collaborative discussion, curved desks have been added in some rooms, introducing increased interactivity into a traditional teaching space.

The cluster concept is being introduced in other areas of the university as part of a phased development to group together spaces used by faculties, and to provide more flexible updated teaching accommodation. Plans are under way to provide social spaces adjacent to some. The Teaching Cluster developed out of a need for pedagogic change, but is encouraging the university to rethink its allocation of teaching spaces on a wider scale.

An example of a Teaching Cluster is the Crawfurd Complex. Mobile stackable seating enables conferences, cinema screenings, theatrical performances and innovative teaching sessions to take place in one larger space linked to two or three smaller ones by video and audio links, which supports both small and large scale activities. However, for more expensively equipped spaces such as the £1.8 million Crawfurd Complex to be used to capacity, they must be centrally managed and bookable.

'Active, collaborative learning', a JISC video case study illustrating the changes introduced in the Department of Mechanical Engineering, can be viewed at **www.elearning.ac.uk/innoprac/practitioner/strathclyde.html**



Source: University of Strathclyde

Planning and management of spaces

An institution planning such changes will gain from establishing a space management team, which brings together expertise from across the institution. This team will be chaired by a senior manager to ensure effective decision making, and will have representation from estates, IT services, library and student services, teaching and learning development staff, academic staff, and learners themselves. However, independence from established interests within the institution should be maintained.

The team will focus its efforts on assessing the type and quality of estate in different faculties or parts of the institution, to facilitate improvements in space utilisation and oversee the upgrading of accommodation. The availability of technologies within those spaces should form part of regular accommodation audits, but can also help in showing how spaces are used – webcams to record the extent to which rooms are occupied can offer cost savings in the long run. Centralised online booking systems are also gaining ground in both further and higher education as a means of increasing effectiveness in managing space utilisation.

Institutional structures for the planning and management of spaces will vary, but must involve IT teams to ensure that new designs are both technology-rich and feasible. To ensure that learning technologies are effectively embedded into the design of innovative learning and teaching spaces, it is recommended that a senior member of the IT team is involved at the highest level of decision making.

Looking to the future

If we are to foster truly flexible, creative and adaptable minds, we need to look more critically at the extent to which learning space designs promote innovative ways of thinking. This has been the aim of the joint Centre of Excellence in Teaching and Learning (CETL) initiative between the University of Sussex and Brighton University, which has developed an experimental new teaching and learning space, the Creativity Zone, drawing on a blend of expertise in engineering, cognitive science, pedagogy and design from both universities.

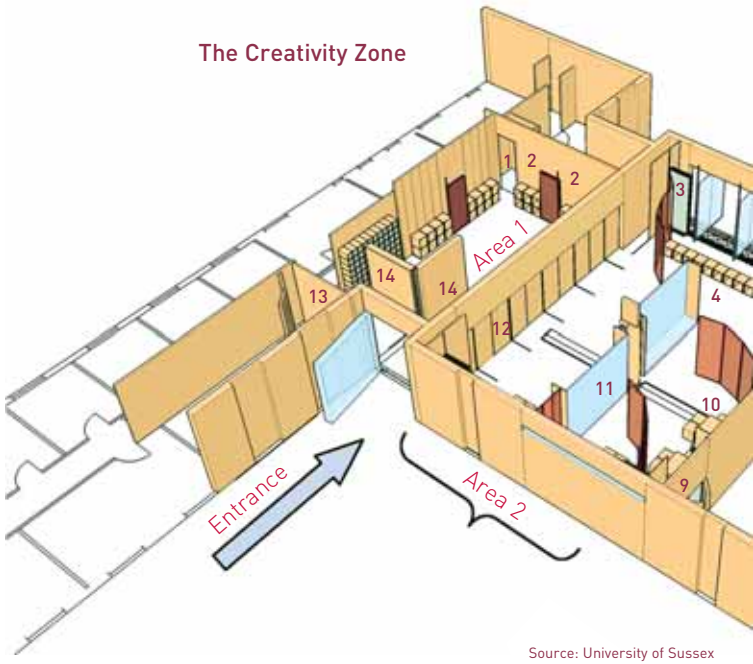
Although relatively small in size (a total of approximately 300 sq. m.), the Creativity Zone could revolutionise teaching and learning by blurring the boundaries between disciplines, between formal and informal learning, and between learning and creative practice. Essentially two spaces joined together in an L shape, it can be partitioned and reconfigured in many ways to meet a breadth of educational and performance requirements. Ingenious partitions, screens and items of furniture are fitted into the fabric of the space. Multiple projectors, wireless connectivity and location-aware technology mean that the experience generated in any part of the space can be varied to offer a progression of opportunities for thought and interaction, both with objects and other participants. A flexible infrastructure supports each activity and stage in the voyage of discovery.

In this space practitioners act like set designers – supported by learning technologists and facilitators, they can simulate real-world practices in microcosm by deploying light, sound and objects to create an immersive, cross-disciplinary experience. Sessions in the Zone will support learners in working towards new understandings, for example bringing individuals from different disciplines together in one collaborative exercise.

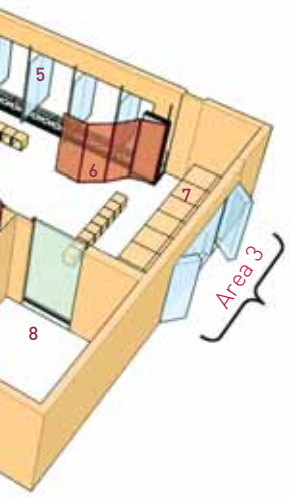
A database of activities and 'learning journeys' will be generated from its use, to widen our understanding of how physical space design can impact on learning outcomes.

The Creativity Zone combines a range of innovative features, any one of which could be the prototype for taking forward our understanding of what constitutes learning and teaching for the 21st century. While not all of these will be present in every future teaching space, promoting creative ways of thinking will almost certainly have higher priority.

The Creativity Zone



Source: University of Sussex



1 Small pod with plasma screen for individual reflection

2 Spaces for wall-mounted touch-screens

3 Array of sliding screens with various surfaces

4 Mobile storage/seating cubes

5 Revolving windows with white 'blackout' screens

6 Fold out 'concertina' screens for display, projection and partition

7 Raised stage area formed of larger cube storage units

8 Control room

9 Storage area

10 Fold-down tables

11 Two independently revolving walls with display boards, interactive touch-screen and fold-down work surfaces

12 Revolving display board wall

13 Refreshment point

14 Revolving screens with interactive touch-screen and display boards

The Robinson Rooms, London School of Economics and Political Science (LSE)

The Robinson Rooms illustrate how an experimental teaching space has been created within the constraints of an existing structure. In 2004, redundant catering facilities were redesigned to provide three interconnecting rooms, the largest seating up to 50, and an audiovisual control centre. This space was to have two aims: to support innovative approaches to teaching and learning in the institution, and to provide a bookable conference and accelerated solutions environment for external clients. At a cost of £60,000, more than half of which was spent on technology and furniture, the refurbishment has been a cost-effective way of setting up a test-bed for design of teaching spaces throughout the institution.

A comprehensive range of technologies was built in to the three rooms: video streaming, audio zoning, mobile interactive whiteboards with projection facilities, video conferencing, wireless networking, tablet PC banks, magnetic work walls, a personal response system, voting devices and recording facilities. Every item in the space is on wheels, from the interactive whiteboard to the tables – this means the rooms can be quickly emptied and reconfigured. Activities can then be captured on video and uploaded to a website or the VLE for further analysis.

This is an environment for collaborative and explorative learning. It can be booked for special events, such as whole-day workshops, when graphic artists and technical support teams can be called in to capture a record of the outcomes. At other times, it is used routinely for classes.

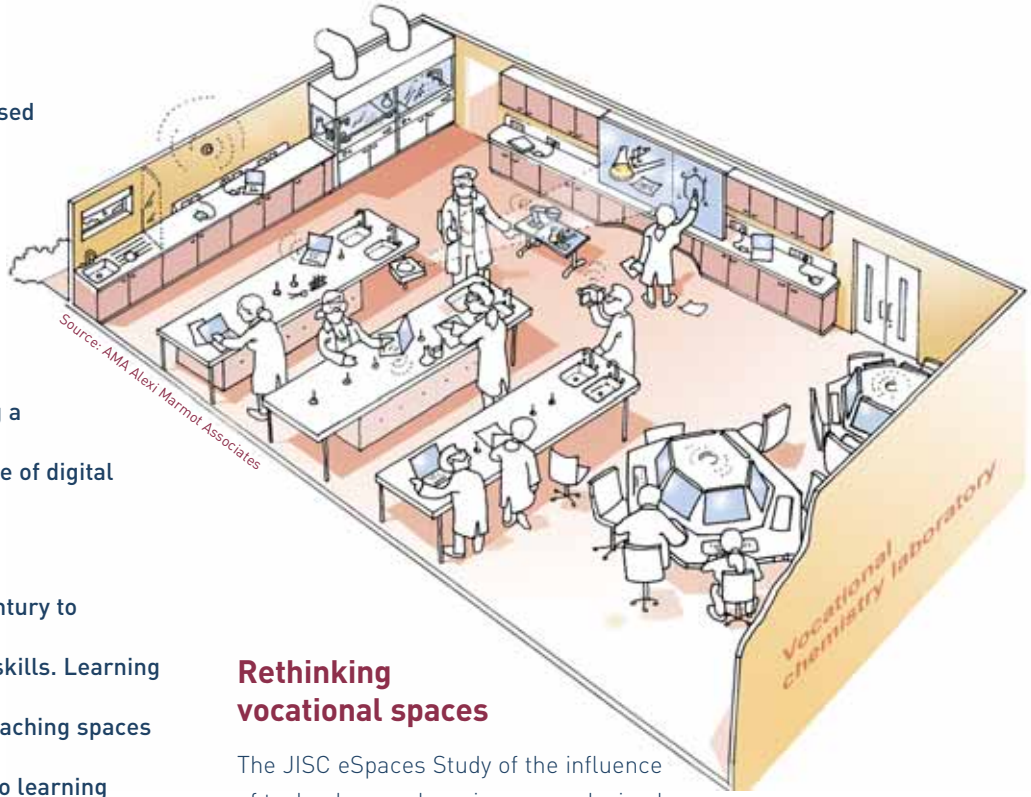
"The creation of innovative learning spaces is a journey. We have created a space in which we are still finding out more about teaching and learning."

Garrick Jones, Fellow of the Institute of Social Psychology, London School of Economics and Political Science (LSE)

Vocational teaching spaces

Vocational spaces are diverse, and have highly specialised requirements for equipment, room size and supporting infrastructure. As a result, the use of learning technologies within these environments has not always been given priority. Vocational areas have often lagged behind other parts of the institution in providing a technology-rich learning experience, apart from the use of digital equipment in particular activities.

However, a higher priority is being given in the 21st century to developing learners' creativity, adaptability and wider skills. Learning technologies embedded into the design of vocational teaching spaces can make a difference by providing immediate access to learning resources, diversifying routes to understanding, and supporting opportunities for on-the-spot recording and assessment of skills.



Source: AMA Alexi Marmot Associates

Rethinking vocational spaces

The JISC eSpaces Study of the influence of technology on learning space design by Birmingham University identifies two key drivers – pedagogic and operational. Operational drivers may have particular relevance for vocational areas – the need to refurbish ageing or scattered estate, and the impact of changes in the economy and in demand for types of courses have frequently prompted institutions to reassess their provision.

Pedagogic drivers matter too. Laboratory or workshop-based learning and outreach classes can all too often be a narrowly-focused experience which takes place in outdated environments at a distance from the main campus. But this need not be the case.

Implementing a wireless local area network (WLAN) can revolutionise approaches to teaching on vocational courses. If a WLAN can be set up in vocational teaching spaces (local conditions allowing), access to web-based learning resources from mobile devices can give vocational learners more immediate opportunities to reinforce their understanding 'on the fly'. Adding a presentation area with a screen and projector to a workshop environment will also help to enhance learning. Vocational learners need to develop e-portfolios and update learning diaries, and an environment with prompt access to IT will support these essential activities.

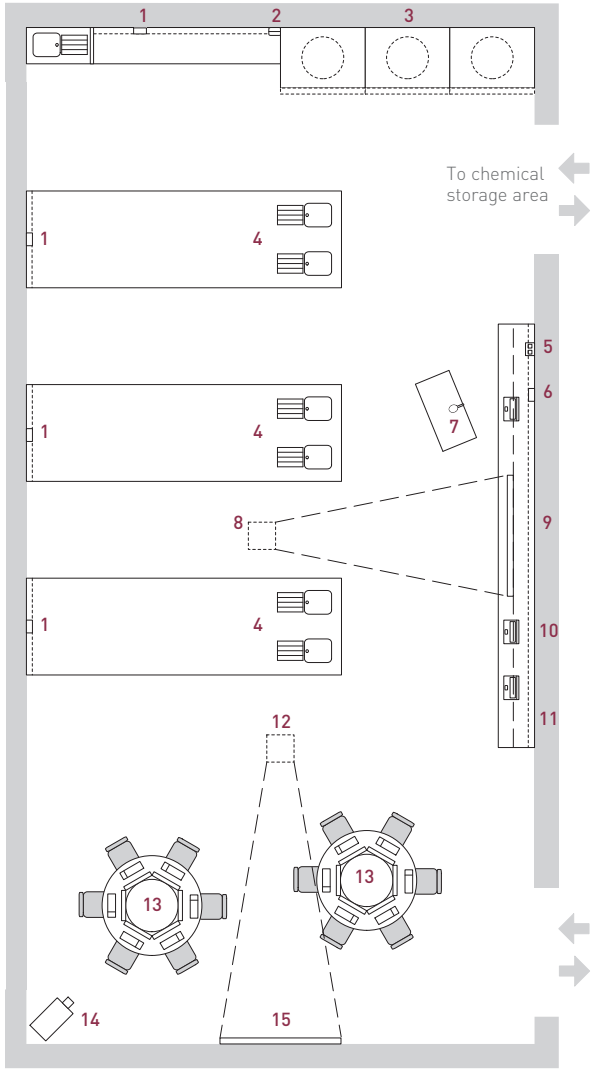
On the other hand, refurbishment of existing spaces may not always be feasible. Inflexible room sizes, costly repairs to external structures, the presence of hazards such as asbestos, and mounting costs of maintaining scattered estate are some powerful reasons for starting afresh.

Integrated technologies

It is likely that audiovisual media will play an increasing role in 21st century learning and teaching. Cameras can capture demonstrations by experts for later replaying, and can also record the level of the learner's achievement for e-assessment. In many simulation environments, video cameras are also a teaching aid, used to record performances in tasks, so that techniques and skills can be improved.

The floor plan featured here is for a prototype laboratory which brings technology, including cameras, into the most challenging environment – the wet chemistry laboratory. The room layout promotes group as well as individual work, supported by laptops at the workbenches. A wall-mounted camera records key demonstrations, which can be uploaded to the VLE for distribution to learners working remotely, or for revision purposes, while multiple projectors enable tutors to project examples onto display screens above the benches. Durable and low-cost mobile devices such as laptops and PDAs encourage learners to access resources on the institution's network and the internet, and write up their observations as they progress.

Vocational spaces – chemistry laboratory



Raised floor and ample perimeter cabling for easy access to power and data.

1 Power sockets
2 Wireless hub
3 Fume cupboards 1 per bench
4 Lab benches with services and sinks
5 Equipment charger
6 Power sockets for recharging laptops and PDAs
7 Mobile unit with wireless visualiser
8 Ceiling-mounted main projector
9 Wall-mounted whiteboard and main projection screen
10 Wired laptops
11 Bench with storage above and below
12 Ceiling-mounted projection or multi-directional central projector
13 Free-standing units with high-level monitors, power sockets and data points
14 Wall-mounted digital video camera for distributed learning
15 Wall-mounted interactive whiteboard and additional projection screen

This floor plan gives a prototype design for a chemistry laboratory. It does not represent a design in any particular institution.
Source: AMA Alexi Marmot Associates