Spaces & Audio Visual Guidelines v3.0.1

Produced by:
ISD Spaces & AV Team
University College London
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About these guidelines

These guidelines have been produced by the UCL Spaces & AV team to help those who are requesting, specifying, designing, supplying, installing, maintaining facilities and environments in UCL's learning spaces.

The Spaces and AV Team within Information Services Division is a recently created team that lead on the design and specification of teaching facilities and audio visual systems across the university. For most UCL capital projects the specification and design of AV systems and associated teaching facilites is undertaken by the UCL Spaces & AV team.

The creation of these guidelines has been undertaken in consultation with and with contributions from the following groups:

- Learning and Teaching Spaces support team
- Estates Room Booking Team

We aim is to consult with all relevant stakeholder groups and any comments or feedback is welcomed at any time (see email below).

These guidelines are not intended to be incontrovertible. Changing pedagogy, technology and an ever developing understanding of the role of technology to support learning will inform the future refinement of these guidelines.

In the context of projects for new or refurbished space projects the guidelines should be used in conjunction with any information gained from the local users of the space and the instructions produced by architects, developers or UCL Estates working on the project.

Since the first publication of these guidelines they have informed some elements of the UCISA/AUDE/SCHOMS UK Higher Education Learning Space Toolkit http://www.ucisa.ac.uk/learningspace. The publication in January 2015 of the national toolkit is a welcome addition to the guidance information available within the sector and is broader in remit than the UCL guidelines. However for the internal purposes of UCL projects the national toolkit does not supercede these guidelines which will continue to be updated and expanded.

Unless stated otherwise all measurements are in mm.

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Section 1: Types of space

There are a variety of types of learning and meeting space within UCL. Below are the three main categories of teaching space as described by Estates with additional sub-categories within those.

Lecture Theatres – these spaces have fixed furniture

- **Large Lecture Theatres** – these spaces accommodate in excess of 50 students, generally have a raked floor and are arranged with fixed seating facing the front. UCL also has some large lecture theatres where there is demountable or retracting seating systems in a flat floored space.
- **Small Lecture Theatres** – 7 of these spaces exist at UCL and they accommodate less than 50 students in fixed seating on a flat floor. Most other institutions would not refer to spaces of this size as lecture theatres.

Classrooms – these spaces have movable furniture

- **Classrooms** – at UCL these spaces accommodate between 6 and 80 students and can have a variety of non-fixed furniture types. In these guidelines the category of classroom is broken down into Extra Small (<10 students), Small (10–30 students) and Medium (31–50 students).

Public Cluster – these spaces have desktop PCs

- **IT cluster spaces** – these spaces provide access to IT equipment and at UCL range in capacity from 10 to 70 individual computers. Generally are available for individual students to use when they are not booked for teaching IT related topics.

Non-teaching spaces – there are also other types of centrally managed learning space beyond the above three Estates Room Bookings categorizations. These spaces are available for student use during the opening hours of the appropriate building.

- **Open-Access computer rooms (cluster spaces)** – these spaces provide access to IT equipment and at UCL these range in capacity from 10 to 170 individual computers.
- **Informal study spaces** – these spaces could be of any size and are not used for teaching. The learning function of the space may be combined with another function (e.g. linking space between buildings or function room at certain times).
- **Small group working spaces** – these spaces accommodate between 3 and 8 students. They can be bookable (usually through the Library issuing system).

Departmental/Faculty managed learning spaces – these spaces are not included in the Estates Room Bookings listings and their booking is undertaken within the department/faculty. The management and support of these spaces is either undertaken by the department/faculty or by one of the 'local but central' elements of Information Services (e.g. IT for SLMS, IT for Humanities or IT for IOE)

- **Classrooms** – there is a wide variety departmentally/faculty managed classrooms within UCL.

- **Specialist workshops or laboratories** – there is a wide variety of this type of space but it is not within scope of these guidelines.
- **Common room spaces** – these spaces provide areas to socialise and relax. They are not specifically designed to support learning but may accommodate facilities for this and may be used by students for this purpose.

Non-space facilities – these are not specific spaces but instead facilities that support student learning and are located within spaces that may or may not be learning focussed.

- **Technology touchdown points** – these are facilities for students to use their own portable/mobile technology in conjunction with University provided services. These are also sometimes referred to as 'Perch Points'.
- **Technology quick access points** – these are facilities for students to use University provided technology to quickly access online services (e.g. check email, check library catalogue).

Meeting rooms – most administration, research and professional service elements of the university have dedicated meeting rooms. These vary in size and the complexity of the systems within them according to the needs of the users.

- **Professional Services meeting rooms** – these meeting rooom are supported by Information Services Division. At present most of these only contain presentation technology but the ability to use web conferencing tools (e.g. Skype for Business) is being added where possible.
- **Departmental meeting rooms** – these are facilities that are not supported by Information Services Division but the Spaces & AV team can advise on suitable design solutions for them.

Section 2: Generic Guidance for all Learning Spaces

2.01 Access to spaces

All learning spaces should be as accessible to learners as is reasonably practicable. It is recognised that much of the UCL estate comprises historic and often listed buildings that may make achieving universal accessibility difficult or impossible for certain locations. Where there are accessibility issues for certain spaces this should be recognised in listings of spaces (e.g. online room bookings system) and route signage (to prevent the avoidable frustration of journeys that cannot be completed).

All refurbishments of UCL space and building of new spaces will be in accordance with the Inclusive Design Standard published by UCL Estates. Overall control of the teaching quality of UCL teaching space will be through the Learning Spaces Quality Group.

The times that a space is available should be shown in both online listings of spaces and direct signage outside the entrance to the space. This signage can be static (e.g. paper sheets in frames) or electronic (digital signage). For spaces that are available for learners to use without staff presence (e.g. IT Cluster spaces) the availability of the space, and the facilities within it in respect of IT facilities, should be accessible via the online PC Availability service (visible in the UCL Go! mobile app and on the ISD website).

Doors onto learning spaces should, where possible, contain glazed vision panels so that it can be seen if there is a teaching session in progress prior to entering and the risk of accidents caused by doors opening onto other people is minimised. Opportunities to achieve this are, for example, when doors are being renewed during building refurbishments. For spaces with large or heavy doors consideration should be given to fitting motorised openers to assist access to those with a disability.

UCL Estates have published a guide to the positive and difficult access features of each centrally bookable teaching space:

http://www.ucl.ac.uk/estates/roombooking/access-guide/access-guide.pdf

2.02 Signage

The existing external signage across the UCL estate is generally of a high standard. Within buildings direction signage should indicate the location of nearby learning spaces. If possible prominence should be given on direction signage to spaces that can be used by learners without staff presence (e.g. informal learning spaces, IT cluster spaces, technology touchdown points and common room spaces). The rationale for this is that locating these spaces is 'optional' for learners and evidence suggests that it is only the more prominent examples of these spaces that are used and known to our students (e.g. regular queues for DMS Watson Cluster PCs when other vacant alternatives exist).

As detailed in Section 2.01 signage should exist on, or in the proximity of (preferable), the door or entrance to the learning space indicating both the name of the space and its current availability. The provision of signage will be in accordance with the UCL Signage Strategy. For further advice on signage please email efdservices@ucl.ac.uk

2.03 Branding of centrally bookable spaces

It is the intention of UCL to create flexible spaces but we would like to establish a UCL look and feel to each space. The common elements will include the use of the UCL logo and wording on all signage; room layout and information sheets; wall protecting vinyl dido rail at chair back height; the use of the same carpet range and paints (in a range of options to suit the buildings). UCL project processes will provide for consultation but within the agreed palette.

2.04 Furniture

Furniture must comply with all current legislation, regulations, standards and policies thus ensuring such is fit for purpose for public use. All furniture and equipment shall comply with relevant British Standards including those for environmental concerns (A or A+) strength, stability and flame resistance the furniture will also comply with industry codes of practice (i.e. BS8300).

The furniture will fulfil all the necessary criteria including BS6396 specification for electrical systems in office furniture. All furniture shall be tested to current FIRA standards.

For classrooms designated as small or medium the type of furniture used will be designed to complement the room's primary and secondary functions – academic use will consider tables (size of writing space, flip top, stacking, and exam compatible); writing tablet enabled chairs or chairs that stack; student society and conference use will be facilitated by the inherent flexibility of choice and the high quality chosen.

2.05 Daylight control and ventilation

Where possible learning spaces should permit controlled admission of daylight. However priority should always be given to the effectiveness of teaching and learning facilities (e.g. projection or display screens) so effective daylight controls (blinds, shades etc.) need to be provided and the location of such screens needs to take daylight openings into consideration.

Traditionally blackout blinds have been specified in teaching spaces such as lecture theatres. In the majority of cases there is not a sufficent justification to warrant full blackout blinds. Perforated or semi-translucent materials will often provide sufficent

In spaces where it is practical it should be possible to open windows for natural ventilation. Reasons this may not be practical include: noisy or polluted external environment; security risk or air conditioning effectiveness.

2.06 Air handling and/or air conditioning

If the space cannot be adequately naturally ventilated to maintain a comfortable learning environment then a mechanical air handling system and/or air conditioning may be required. Controls for air conditioning are notoriously complex and therefore clear instructions should be produced and positioned alongside the controls. The merits of providing end user controls versus not providing end user controls is included in the guidelines for specific types of learning space.

The lighting design in learning spaces has to meet a number of aims. Students need to be able to see the presenter and what is being presented (whether that be via electronic means, writing on a board or the use of objects). Students should also be sitting in enough light to be able to make handwritten notes. Care should be taken over the placement of luminaires in relation to projection and/or writing surfaces. A common mistake is the positioning of a luminaire directly above the projection surface which results in uneven image contrast. Illumination of writing surfaces should be as even/flat as possible to avoid legibility issues. When rooms are being refurbished consideration should be given to the feasibility of relocating inappropriately located luminaires.

Learners using tablet computers for note taking can experience harsh reflections from certain designs of modular recessed fluorescent luminaries due to the horizontal angle that tablets are used at. Therefore care should be taken in selection of luminaries that use indirect illumination and the use of mirrored diffusers should be avoided if possible in learning spaces.

Low energy lamps that require more than 10 seconds to reach maximum brightness are not suitable for usage in learning spaces due to the likely need to regularly change between different lighting states within a taught session. Likewise LED luminaries that cannot be dimmed are not suitable for learnign spaces.

Luminaires specified for new or refurbished learning spaces should give high frequency (no flicker) light output. General area lighting should have a colour temperature proximate to daylight (>5000ºK) whereas with breakout or small group learning spaces consideration should be given to having a directional pendant that focuses warmer (≤3200ºK) light on the centre of the discussion area.

Feature lighting is desirable to include within the lighting scheme if the design of the space can be planned to include it and the space may be used for non-teaching events. An example of successful feature lighting is the recessed strip lighting featuring the riveted steel beams in the Foster Court Basement PC Cluster.

above: recessed feature lighting

Reference

"Indirect lighting, while uniform, can also be monotonous, lacking shadow and contrast. Accent lighting on display areas or white boards enlivens a space. Recessed cove lights or pendant mounted directional fluorescents provide accent and task lighting efficiently."

http://www.designshare.com/Research/Lighting/LightingEnvr1.htm

In most spaces a programmable lighting system is installed. Provision of four different lighting states is usually sufficient to cover all teaching needs without overloading with choice.

Where controllable lighting is installed the control system will be expected to provide control over scene selection from the touch panel installed in the teaching station or on the wall. Control interface should be via IP or RS232.

Typically lighting systems should be designed to come on to a predefined 'all-on' state when a person enters the space. This is achieved by the use of a suitably located occupancy sensor. However when occupancy sensing is used caution should be employed because a lecture audience or an exam in a computer cluster room can be relatively static. Therefore to avoid inappropriate light switching it is important that the sensor technology employed is capable of detecting static occupancy as well as movement.

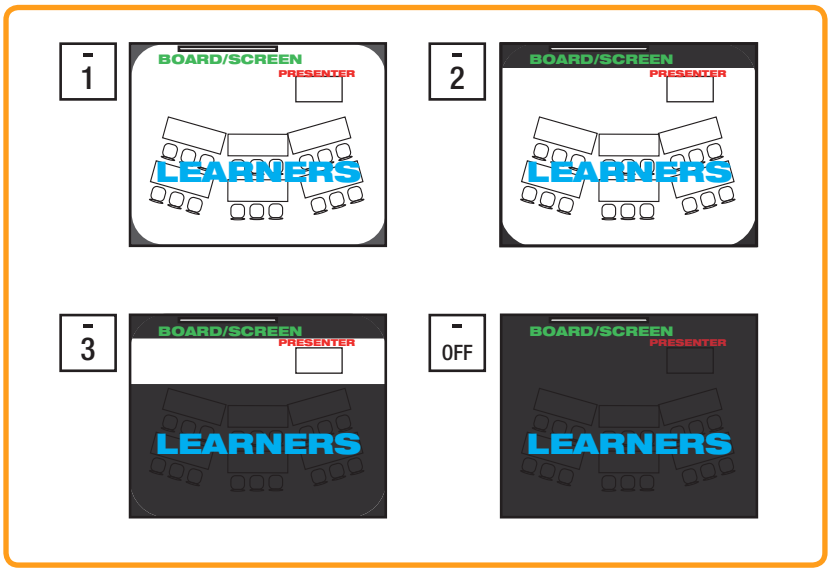
A panel with physical lighting controls should then be available in an appropriate location so the lighting can be controlled without the use of the AV system.

Selection of lighting controls with superfluous buttons (more buttons than are needed) and that are unlabelled should be avoided because this can confuse the end user.

above: example of unlabelled lighting control

Where possible the lighting controls should be replicated on the control panel on the teaching station so that the lighting can be easily optimised by the lecturer for different sections of the session.

When the lighting scene selection controls are replicated on the teaching station, and if the physical configuration of the light fittings in the space permit, the system should be designed to react to the activation/deactivation of the projector (e.g. when the projector is showing an image the wash luminarie lighting a column board would be off and when the projector is either blanked or turned off then the wash luminaire would come on).



above: example of desirable lighting states

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.

The area the presenter typically stands in should be able to lit independently of writing or projection surfaces. With Lecturecast present in many spaces it is important that the presenter is well lit even if only low lighting is required on the teaching wall. Without this independent control the presenter either has to risk the projected image being 'washed out' or has to present in near darkness and only a silhouette is captured on the Lecturecast camera.

The requirements for emergency lighting in learning spaces is detailed in *UCL Fire Technical Note No: 020*.

Reference

UCL Fire Technical Note No: 020 is available at:

http://www.ucl.ac.uk/estates/maintenance/fire/documents/

2.08 Wi-fi

Wi-fi network connectivity should be viewed as a basic requirement of any learning space regardless of whatever other technology is present in the room. When provisioning wi-fi, in addition to ensuring the system design provides guaranteed 100% coverage within the space, the capacity of the system should be designed to accommodate a number of concurrent connections that is 5x the maximum number of people expected to occupy the space at any one time. The logic behind this multiplication factor is that currently 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 wi-fi connections.

2.09 Clocks

All teaching spaces should have a working analogue clock visible to the tutor. At present UCL does not have a centrally supported network clock service but it is desirable that a standard for clocks in teaching is specified and implemented. Therefore in new and refurbished spaces provision should be made for a network point in the appropriate clock position and a suitable non-battery clock installed.

2.10 Acoustics and noise

Acoustic design of the learning space will usually be within the realm of the architect. However relatively minor refurbishments, especially involving removal of any materials with high absorption coefficient (fabrics, ceiling tiles etc.), may have a significant impact on the acoustics of a space.

Also the addition of air handling/conditioning equipment into learning spaces should be planned carefully in order to ensure that the noise rating of the space is within set limits. HVAC plant should either be located away from the learning space or noise control measures put in place.

In the UK no specific standards are defined for the acoustic performance of University learning spaces. However it is useful to refer to the Department for Education's "Building Bulletin 93: Acoustic design in schools" document. Although this document is in the process of being superseded it is currently recommended by the DfE that it continues to be used for guidance.

In BB93 the A weighted sound pressure values specified for the upper limits for indoor ambient noise levels for different types of learning space are:

Type of space	Upper limit for the indoor ambient noise level L_{Aeq},30mins dB
Classrooms	35 (40 for refurbishments)
Lecture Theatres	35 (40 for refurbishments)
ICT Rooms (PC Cluster rooms)	40 (45 for refurbishments)

Whilst it may not realistic for the internal UCL teams to make measurements of ambient noise levels these figures are useful as a standard to pass onto architects and designers of our learning spaces.

On a practical level sources of noise such as metal waste/recycling bins and vending machines should not be located immediately outside the entrances to learning spaces. For larger learning spaces it is desirable to have entrances that comprise of two sets of part-glazed doors with a sound suppressing lobby in between.

In teaching spaces such as lecture theatres the reverberation time needs particular attention during the design stage (for new builds or for major refurbishments):

Type of space	Performance standards for reverberation time T_{mf} seconds
Classrooms	≤0.8 (≤1.0 for refurbishments)
Lecture Theatres	≤1.0 (≤1.0 for refurbishments)
ICT Rooms (PC Cluster rooms)	≤0.8 (≤1.0 for refurbishments)

Reference

"Part E does not apply to nursery schools which are not part of a school, sixth form colleges which have not been established as schools, and Universities or Colleges of Further and Higher Education. However, many of the acoustic specifications are desirable and can be used as a guide to the design of these buildings."

https://www.education.gov.uk/publications/standard/publicationDetail/Page1/BB93

2.11 Assistive listening systems

UCL

Hearing impaired students can benefit greatly from clearer and more intelligible audio if the learning space they are in has an assistive listening system (ALS) installed. There are a variety of different types of ALS:

- Infrared (IR) systems – where the user is issued with a IR receiver with its own earpieces and there has to be an unobstructed line-of-sight between the IR transmitter and the IR receiver worn by the user. Drawbacks include the institution having to issue receivers, maintaining the hygiene of the receivers and the fact that hear impaired users are differentiated from their peers by having to wear an obvious device.
- Frequency Modulation (FM) systems – these use licenced FM bands and require the user to wear a specific receiver with its own earpieces. Drawbacks include the costs of licencing, the institution having to issue receivers, maintaining the hygiene of the receivers and the fact that hear impaired users are differentiated from their peers by having to wear an obvious device.
- Induction Loop systems – these work by sending an input signal to a loop driver to produce an electromagnetic field from a number of wires placed around the space (usually under the carpet). Those with hearing impairments then move a switch on their hearing aid to the 'T' position which makes use of a telecoil (present in 95% of hearing aids) to pick up the output signal. Whilst these system are more disruptive, and thus costly, to install they have many advantages over the other two system types. These include the fact that the hearing impaired person is using their own hearing aid which is likely to have a frequency response tailored to the specific nature of their impairment.

ALS via wi-fi is starting to appear on the market but at the time of writing none of the systems available appear suitable for university use.

UCL has standardised on using Induction Loop systems that conform to IEC60118-4 2014 and BS 7594-2011.

An important element regardless of which transmission method is used is the quality and appropriateness of the input microphone. The selection of appropriate microphone types is covered in Section 3.10.

Every space that has an induction loop installed should have the international standard signage displayed so that users are aware of its existence.

UCL aims to install induction loops into all teaching spaces of ≥50 capacity. Teaching cluster rooms can be particularly challenging for the hearing impaired so sometimes loops are installed in these rooms even if the capacity is below 50.

Most loops that UCL implements are 'low-spill' phase-array design. This enables different loop systems to operate in close horizontal proximity to each other. However vertical spill is more difficult to control and can limit the solutions that can be achieved when spaces are directly above each other.

Reference

The international standard signage to indicate the existence of an audio induction loop.

Section 3: AV Facilities and Teaching Station

3.01 Audio visual facilities

The audio visual facilities within learning spaces will need to vary dependant upon the intended function, size and physical layout of the space. It is desirable to standardise the user interface and operation method of audio visual facilities across all spaces so that teaching staff can gain confidence in how to use the facilities and know that once they've mastered the facilities in one space that this is transferable across spaces.

Detailed technical specification of the equipment that makes up the typical audio visual provision and its configuration within different categories of learning space are included in the relevant sections but this section details are over-arching principles.

3.02 Teaching Station design

All controls and interfaces for the audio visual facilities within a learning space should ideally be located on a single 'Teaching Station'. This is a single piece of furniture that provides working surfaces and secure accommodation for equipment.

The siting of the teaching station within a learning space should be carefully considered to take into account these factors:

- the lecturer should be able to face the students when operating the facilities and the facilities themselves should not inhibit the lecturer's view of the students
- the teaching station should not be located so that its use would inhibit the students' view of presentation display surfaces
- the siting of the teaching station should not inhibit ingress or egress of users to the space

The design of the teaching station should enable its use by people of different heights and if there is a horizontal writing/presentation surface provided (e.g. visualiser) then this surface should ideally be height adjustable to facilitate comfortable usage when standing for users of differing heights.

3.03 Equipment rack specification

The teaching station should contain an equipment cabinet to accommodate standard 19" rack-mountable equipment.

Rack build specifications

- all doors must lock with a suited key
- equipment rack ears must be secured with screw cover bars
- doors should open away from the centre of the teaching station panel screws must be security head type
- racks to contain lacing bars for cable management
- all installed cables must be strain relieved, tied to lacing bars and have sufficient spare for items of equipment to be safely removed from racks and housings without removing cable ties or fixings
- no installed devices should be accessible to users to unplug or remove.

- any equipment fitted to shelves in a rack must be securely fixed to the shelf
- all screws and bolts should be stainless steel security head types fitted with plastic barrier washers underneath
- power cables should always be run on the left side of the rack and signal cables on the right (when viewed into the rear of the rack)
- power distribution in racks should be done via a PDU
- all racks must be populated according to the elevation plan provided by the University
- any unused rack spaces should be covered with blanking panels in order to prevent unauthorised access to the rear of equipment or the storage of inappropriate items within the equipment cabinet.
- no company branding shall appear on blanking panel.
- controls and configurations that are not appropriate for end users (e.g. power amplifier output levels, audio loop configuration, radio microphone channel setting) should be concealed behind a lockable door on the equipment cabinet (unless this equipment is located in another secure location)

Rack cable labelling

All cabling must be clearly labelled on both ends with the identifiers detailed on the schematics and cable pull sheets. In most instances this should be done using cable number clips (example product - Hellerman Oval grip). Where a label is more appropriate this must be machine printed and covered by a clear heat shrink to protect it.

- all labels must be attached within 300mm of the connector ends (Typically @ 150mm) and must be visible outside of any snake skin or containment
- all Cable identifiers must be of a consistent font, font size and be orientated so that cable does not need to be removed or twisted to be read
- all identifiers must be attached so text is presented in a single straight line and must be sized appropriately so they do not move on the cable sleeve once attached
- all text and background colours must be of sufficient contrast to be clearly legible
- patch and Connection plates should have engraved labels fitted to match the number of the connecting cable

3.04

Teaching station wall/floor connections

UCL

Connections from the teaching station to the other equipment and services within the space are a potential point of failure and should not be accessible to staff or students. Therefore UCL specifies that connections should either be made in a floor box located beneath the teaching station (where it will be inaccessible to end users) or into a connector enclosure on the wall.

Enlosure specification

- all enclosures must be securely mounted and all metal enclosures must be grounded
- all entry and exit points must be protected with grommets / grommet strip securely fastened
- any keys must be suited by project (unless an existing suite for that enclosure type exists in which case the existing one should be used)
- floor boxes must be sufficiently deep to close their lid completely without bending or fouling any connectors or cables (bend radius' must be observed)
- any power connections made internally must be shielded to isolate them from other signal paths
- flying tails can be presented in enclosures but must include load restraint adjacent to each connector and all connections must be a locking type
- if cables must run over a floor then they must be contained in a suitable floor ramp system that is fixed to the floor

Connector types

- all connectors should be metal (screw together) or single piece moulded plastic. Clip together chassis are not acceptable
- all installed cables must be strain relieved and have sufficient spare for items of equipment to be safely removed from racks and housings without removing cable ties or fixings
- barrel connectors between cables must be screw together type.
- where connector types need to be changed across a single cable path (e.g. DVI on one end, HDMI on the other) a single cable with the correct connectors on the ends should be used
- if adaptors are the only way to achieve this they must be screw fit types and must be installed in a way that does not place load on the connector end

Colour coding

Patch and connection panel connectors should be colour coded to their corresponding sockets (in panels or mating connector) as per the following convention:

Purpose	Standard	Connector	Colour
Lecturecast (and induction loop if applicable) ceiling-mounted microphone	Balanced mic level	3 or 5 pole XLR	Orange
Voice reinforcement loudspeakers	100V Line / 2 or 4 pole Neutrik Speakon	2 or 4 pole Neutrik Speakon	Yellow
Programme sound loudspeakers	Low impedance	2 channels on single 4 pole Neutrik Speakon	Blue
Induction loop connection	RF	2 or 4 pole Neutrik Speakon	Black
Projector / other display devices	HDbaseT (or equivalent) AV Cat 6a	Sheilded Neutrik RJ45	Red
Ceiling-mounted document camera (visualiser)	HDbaseT (or equivalent) AV Cat 6a	Sheilded Neutrik RJ45	Green
Lecturecast camera	3G-SDI	BNC	Violet
Auxillary media outputs	3G-SDI, HDbaseT or HDMI	BNC. RJ45 or HDMI	White
Auxillary microphones	Balanced mic level	3 pole XLR	Grey
Network interface	TCP/IP	RJ45	Brown

3.05 Controls for the Teaching Station

UCL

All the key functionality of the equipment within the teaching station should be controllable from a single touch sensitive control panel. The rationale for this approach is that it permits a variety of equipment types to be controlled from a standardised user interface. It also does away with the need to provide tethered infrared remote controls for certain equipment.

UCL provides its AV installers with a copy of the standard control panel programme which includes pre-coded functionality for most systems.

Event	User action	System behaviour
AV System Wake	Welcome screen touched / Energy saver off	Display of interface home screen on touch panel
Display	Any input selected on interface home screen If integration to room lighting system applicable to room then switch to lighting state 2	Projector and/or panel displays to power up
Image blank	Image Blank button on interface screen pressed Display to lectern confidence monitor remains on currently selected input If integration to room lighting system applicable to room then switch to lighting state 1 (all on)	All audience-facing display devices are set to 100% black.

Event	User action	System behaviour
Image reveal	Image Reveal button on interface screen pressed If integration to room lighting system applicable to room then switch to lighting state 2	All audience-facing display devices show current source.
Shutdown	Shutdown button on interface screen pressed	Shutdown confirmation or cancel screen displayed on touch panel
Shutdown confirmation positive	Second Shutdown button on confirmation interface screen pressed Routing to lectern confidence monitor set to display resident PC If integration to room lighting system applicable to room then switch to lighting state 1 (all on)	System put into power saving standby state (display devices switched into standby mode)
Shutdown confirmation negative	Cancel Shutdown button on confirmation interface screen pressed	Returns to state as before entering Shutdown confirmation interface
Input selected (all)	Any input selected by user	Input displayed to audience facing displays and lectern confidence monitor

3.06 Resident PC within Teaching Station

All learning spaces equipped with a teaching station should contain a fixed personal computer configured to the UCL standard for teaching machines.

The PC should have a wired keyboard and mouse to avoid issues of depleted batteries in wireless units.

The USB connections of the computer should be extened to labelled sockets presented at the worktop to avoid the need to crouch down to find the sockets on the front of the PC. The energy management and updater options on the fixed personal computers in learning spaces should be configured to:

- Not activate a screen saver
- Not auto log-out after a period of activity
- Not display on-screen notifications about system or application updates available

3.07 Support for portable devices

In addition to the resident PC there should be the facility to connect a portable computer, tablet device or video device to the teaching station for display onto the presentation surface(s).

Connections offered should include:

- HDMI
- VGA connection paired with attached 3.5mm jack plug audio input (the audio connection requires approximately 300mm of independant cable from the VGA connection in order to work with different designs of laptop)

The leads provides should be a suitable length so as to provide flexibility to the end user where they put their device on the worktop. Ideally the leads should be able to be retracted into the teaching station in order to minimise clutter on the worktop.

3.08 Visualiser

Visualisers, also known as document cameras, can be used in the following ways:

- to write underneath
- to display documents placed on the working surface
- to display objects placed on the working surface
- to project transparency slides that were previously used with a Overhead Projector
- to project 35mm slides via the slide carrier integrated into the lens mount of some visualisers

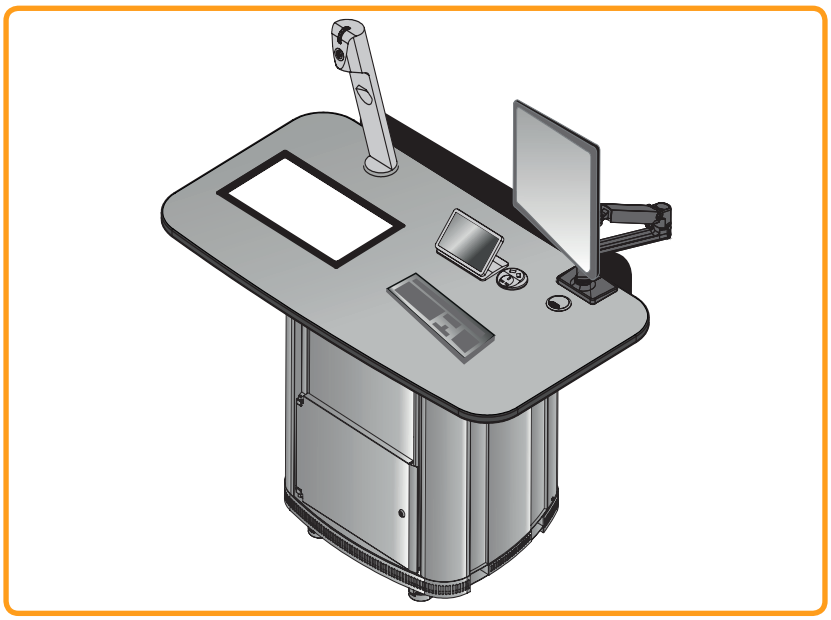
However it has to be recognised that writing on a horizontal surface at approximately waist height is both challenging from an ergonomic perspective and a very different activity from the traditional skill, honed over years by many staff, of writing large and legibly on a vertical writing surface.

UCL has pioneered in the provision of viualiser solutions that attempt to redress this situation by minimising the drawbacks of using a visualiser for live writing.

Two solutions have now been deployed into many teaching spaces:

- worktop-mounted visualiser with embedded whiteboard surface
- ceiling-mounted visualiser above large whiteboard surface embedded into height-adjustable teaching station.

Visualisers have the benefit of being relatively intuitive to understand and not requiring the operator to learn any software prior to use.



above: illustration of teaching station with worktop-mounted visualiser and writing surface recessed into worktop

above: illustration of teaching station with writing surface recessed into worktop which is used under a ceiling-mounted visualiser

3.09 Video playback

Expectations of both students and staff are that regular use of video materials will feature in many teaching interventions. Increasingly replay of video material will be accomplished via streaming, stored content on USB storage connected to the PC, or a portable device connected to the teaching station.

Certain video material may however only be practically or legally available on physical optical media. Video playback facilities are therefore justified within the teaching station. This is accomplished through a optical disc player for 12cm discs with the following compatibility:

- BluRay (Region B)
- DVD (Region 0 and Region 2)
- DVD+R finalised discs
- DVD-R finalised discs
- CD
- CDR finalised discs
- CD photodisc

Optical disc players capable of replaying DVD and/or BluRay from other geographic regions are deployed where there is a specific request from the users of a particular space. However it should be noted that it is often problematic to obtain multi-region players through manufacturer's official supply channels and therefore the practice of installing these players is intentionally minimised in order to ensure business continuity by using players with suitable warranty and after-sales service.

There is no longer any justification for providing tape based video replay equipment.

3.10 Microphones

Microphones in teaching spaces provide signal input to some or all of the following:

- Assistive listening system e.g. induction loop (see Section 2.09)
- Vocal sound reinforcement
- Lecturecast (see Section 3.12)

If any of the above three systems are present in a teaching space then a suitable microphone system should be deployed. The most suitable type of microphone system to deploy in a particular space will depend upon the following variables:

- the size of the space
- the ceiling height above the 'teaching zone'
- the opportunity to install microphone cables running from the teaching station to ceiling locations

Different microphone solutions for different categories of spaces are detailed in the relevant sections of these guidelines.

If wearable or bodypack microphones are specifed in a system:

- they should contain rechargeable batteries that are charged via a charging station
- an increased number of units should be provided in the space to provide redundancy (for lecture theatres there should be two wearable microphones available)
- all charging stations must be securely fixed to the teaching station worktop

If ceiling-mounted microphones are specified in a system:

- the choice of white or black microphones should be specifed as part of the design
- normally ceiling-mounted microphones will be in a white finish

3.11 Amplifiers and loudspeakers

The selection of audio amplifiers and loudspeaker systems should take into account the size, acoustic properties and intended usage of a space. Appropriate placement of loudspeakers is as important as the correct choice of loudspeaker. As a general principle loudspeakers should not be located in room corners as this negatively impacts the amount of direct vs. reflected sound the user will experience.

Another general principle is that it is better to have multiple loudspeakers working at lower volumes than it is to have only a single stereo pair at the front having to be driven loud.

Audio amplifiers for learning spaces should be specified such that in normal use they are never being used at beyond 70% power to ensure there is sufficient 'clean' headroom before distortion or clipping.

Different types of amplifier/loudspeaker systems exist:

- Stereo pair (typically on the teaching wall) – the simplest system comprising of a two channel power amplifier and a pair of individually connected loudspeakers. This solution

is only suitable for small spaces but can offer better stereo imaging and high audio quality.

- Multi-channel speaker system – this will require either a four or six channel amplifier or a number of separate power amplifiers. In larger spaces this solution can have the benefit of being able to apply a delay to the speakers further away from the presenter to compensate for the time the direct sound from the presenter (or more precisely the loudspeakers at the front) takes to the reach the rear of the space. In reality no teaching spaces are likely to need this type treatment. However another advantage of a multi-channel system is that the sound levels in different parts of the space can be easily adjusted.
- Constant-voltage speaker system – also known as a 100V Line system. By using step up and step down transformers (usually built into the audio equipment) longer cable runs and easier multiple loudspeaker installation designs can be achieved. The drawbacks of this type of system include potential degradation of sound quality if the transformers are not of suitable quality and the inability to adjust the relative sound levels between the different loudspeakers (although some can be adjusted at time of installation by using different transformer tappings).
- Single source line array – this type of loudspeaker system comprises multiple loudspeakers in an array of enclosures place near the front of the space. Each element of the enclosure is designed to give a very specific dispersement pattern and through the use of digital sound processing a much more even front-to-back dispersement can be achieved i.e. listeners at the rear of the space will hear sound sources at the same sound level as those at the front. This type of loudspeaker system requires specialist design and installation services to ensure optimal performance in the specific space.

above: a line array loudspeaker system

Regardless of the amplifier/loudspeaker technology deployed within a particular learning space the configuration controls (e.g. power amplifier output levels) should be inaccessible to end users with

only the master volume control via the teaching station control panel available.

3.12 Image display specifications

UCL

Reference

Association of Educational Technology Managers (Australia) "AETM Design Guidelines for Tertiary Teaching Spaces: 2nd Edition" http://www.aetm.org/uploads/media/AETM_Audio_Visual_Design_Guidelines_2nd_Edition.PDF

The dimensions of the presented image in learning spaces should be proportional to the viewing distance. The specification given by the AETM guidelines is that the furthest viewing position should be no more than 5.3 times the height of the display and this forms good general guidance across a range contexts. Therefore this is the recommended viewing distance calculation applied at UCL

In reality the maximum acceptable viewing distance (or conversely the minimum image size) is dependent on the type of material being shown. Giving a demonstration of how to use a software application such as Excel will require students to be able to see much smaller objects and finer detail.

One alternative method for calculating the minimum dimensions for a display within a teaching space is based upon this logic – the '4:6:8 rule'. According to this rule the minimum image height should equal the maximum viewing distance divided by a factor of:

- 4 for Excel documents or items for inspection
- 6 for PowerPoint, graphs or typical presentation material
- 8 for video viewing

For the sake of simplicity it should be assumed that any display being installed in a teaching computer cluster room will be used for detailed viewing and therefore priority should be given to either increasing the display size or reducing viewing distances by the use of multiple or repeater screens.

The type of projector, standard throw v.s. ultra short throw, should be dictated by the display requirements (i.e. minimum dimensions proportional to the maximum viewing distance as per the 5.3 rule above) and the installation/mounting conditons in the location (e.g. avoid UST if a stud wall is not sufficiently sturdy).

In terms of the position of the projection surface most other guidelines specify that the base of the displayed image should be 1200mm from the floor. Whilst this undisputed for standard throw projectors this height should be reduced to 1000mm or 1100mm from the floor when an ultra-short throw projector is being specified. The rationale for the different floor to screen heights is that ultra-short throw projectors may be retrospectively fitted with interactive capabilities and a board mounted at 1200mm from floor is typically too high for use as a interactive writing surface.

Data projectors and computer monitors are made with 16:9 and 16:10 aspect ratios. Some laptops are 16:10 but the majority are 16:9. Other devices such as tablets often have non-standard aspect ratios. Large format LCD displays are almost always 16:9.

In these guidelines it is recognised that the choice between 16:9 and 16:10 is difficult one due to both variations in requirements and variations in available equipment. Therefore the standardised space type designs are based around the predominant aspect ratio of the equipment for that space type:

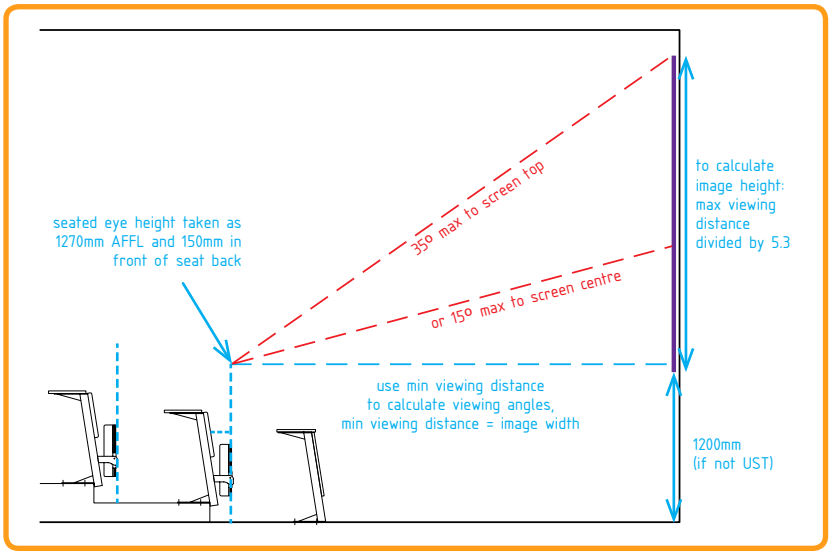
- Extra Small Classrooms use large format displays and thus are 16:9

- Small Classrooms use ultra short throw projectors and thus are 16:9
- Medium Classrooms use standard throw projectors that are 16:9 and thus are 16:9
- Lecture Theatres use standard throw projectors that are 16:10 and thus are 16:10

When using a mix of display technologies in a single system (e.g. LFDs as repeater screens) consideration needs to be given to how and when the signal will be scaled.

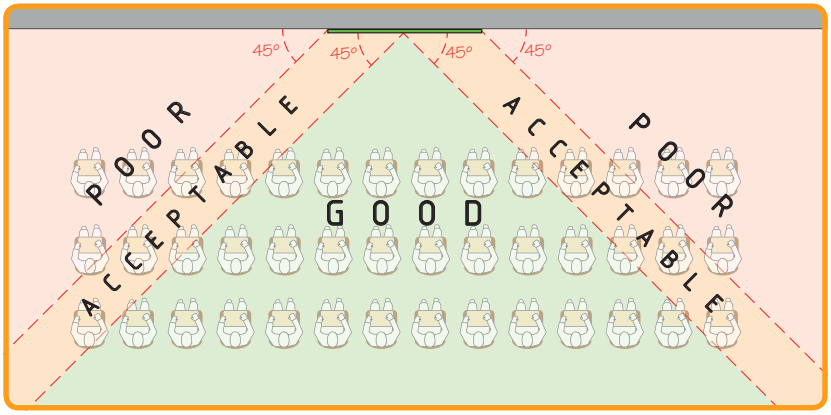
Where existing systems have 4:3 aspect ratio display devices or projection screens these should be replaced with 16:10 facilities.

Calculations should also be made to ensure that the viewing angles for those nearest the screen. 35º to the screen top or 15º to the screen centre are the maximum viewing angles recommended in order to avoid neck strain for viewers.



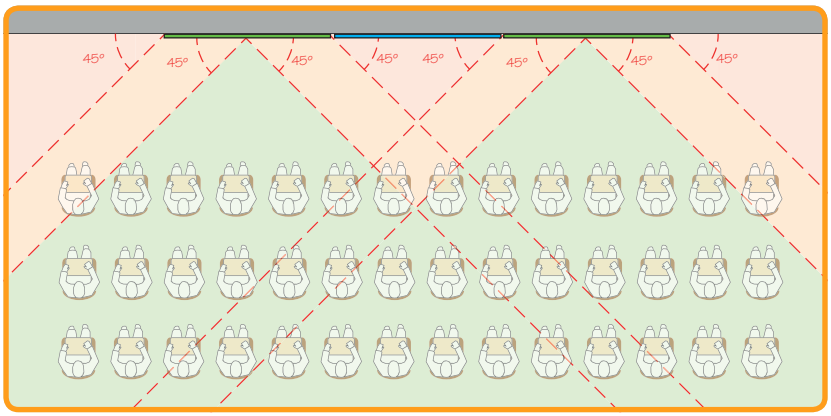
above: illustration of maximum screen viewing angles

The minimum viewing distance (i.e. the closest permissable distance for the nearest student sitting position) is equal to the screen width used.The horizontal viewing angle also needs to be considered when considering the locations of screens in relation to seating positions. Good viewing angles are within an area formed by taking a 45º angle from the image centre. Acceptable viewing angles are within an area formed by taking a 45º angle from the image edge.



above: illustration of horizontal screen viewing angles

In wide spaces greater acceptable horizontal viewing zone can be achieved by using two projectors. In this solution a writing board can be mounted between the two projection screens and if more writing surface is required an additional writing board on a horizontal glide rail system can be added to double the writing area.



above: illustration of horizontal screen viewing area with dual projection

Regardless of the display technology employed the display(s) must reproduce images to the following performance specification:

- accurate colour reproduction (must comply with sRGB standards as a minimum and reproduce all coloured light equally and to the required luminance levels for the screen)
- be free from all perceptable distortion of image shape and size
- be free from all perceptable colour banding, skew, hot spots / dull spots, colour aberration

Reference

Infocomm PISCR standard is available for UCL staff under the institution Infocomm memberhip: https://infocomm.netexam.com/catalog.html?#:cs50542

Brightness, contrast ratio and colour gamut requirements of displays will vary according to the site conditions (e.g. ambient light levels) and the technology employed. The contrast ratio of the image display should be designed to comply with the Infocomm PISCR standard.

All control of displays should be over RS232 or IP. (Full NIC functionality must be available at all times e.g. NIC does not switch off with display off command).

Where it is most appropriate to utilise a data/video projector as the primary display technology care should be taken to ensure that:

- for ceiling-mounted projectors that the stability of the image will not be effected by footfall in the room above nor its proximity to other services such as HVAC
- for ceiling-mounted projectors that the filter can be periodically cleaned, ideally without the need for specialist access equipment
- for wall-mounted projectors that the stability of the wall is sufficient to render a stable image that will not be effected by the closure of nearby doors etc.

In spaces where there is not space to accommodate sliding 'column' whiteboards, nor separate projection screen and a whiteboard alongside each other, a hybrid projection/dry-erase board should be used. In these instances the projector used should be of the Ultra Short Throw (UST) type. UST projectors, whilst limited in terms of maximum image size, have the benefit of not suffering from a 'hot spot' reflecting back to users. In smaller learning spaces UST projectors also have the advantage that the instructor will not obstruct the projector beam if standing in front of the board nor be dazzled by it.

Below is a table showing the advantages/disadvantages of different learning space display solutions:

Solution	Use writing surface and display projected image concurrently	Ease of alternating from written display to projected image (excluding use of visualiser)	Annotate on projected image	Future possibility to capture written board material into Lecturecast
Standard throw projector with pull down or motorised retractable screen in front of shiny whiteboard	No (unless additional whiteboards in space)	Slow and/or difficult to raise and lower screen but can be done without erasing written material	Not possible	Not possible
Ultra-short throw projector with hybrid projection/dry erase board	No (unless additional whiteboards in space)	Have to erase what is written on the board first	Possible	Possible via interactive add-on for the projector
Standard throw projector onto screen behind columns-mounted whiteboards	No (boards are either in front of projection screen or out of direct view)	Easy to raise/lower boards	Not possible	Not possible

Unless a ultra short throw projector has been specified, projectors will be ceiling mounted using an appropriately load-rated mounting pole and plate. A security mounting plate system will be used with a suited key in all locations.

3.14 Projection screens and writing surfaces

Specialist fabric projection screens are too easily damaged to be suitable for most teaching spaces. The exception would be when it is not possible for someone to reach to the screen so there is no risk of unintentional damage by being accidentally written on. Where a rigid projection suface is used it should be a matt finish projection board. The matt projection surface should display a label notifying users that it is not a writing surface and should be surrounded by a black frame. The specification of this projection surface should be such that if it is accidentally written on then it will not be damaged and the marks can be cleaned off via the use of detergent or solvent agents.

Where shiny vitreous enamel boards are fitted alongside the projection surface it can be advantageous to also fit a glide rail board so that additional writing area is available if the lecturer does not require to display a projected image.

Painted screen walls

Where screen wall paint is used surface finish is critical prior to application and must have no lines, dents, depressions, textures or imperfections visible (standard dry lining finish is not adequate, walls must be skimmed with plaster). Paint application varies depending on the use of the system. Paint must be applied by a specialist decorator following application requirements as defined by the manufacturer.

Motorised screens

Projection screens mounted above the ceiling must have an appropriate surround fitted in the ceiling grid. If no false ceiling is present then the screen should be mounted at the appropriate height on the front wall so the bottom of the screen is at 1200mm AFFL.

Depending on the size of the screen and ceiling height, an extended drop may be required.

For larger screens they should be tab tensioned, electric drop down and controlled via a relay connected to the room processor. In the absence of a room control system the screen should have a switch installed on the wall outside of the screen drop area.

3.15 Large format display panels

In certain situations large LCD/LED flat panel displays may either be more suitable as the primary display or used in conjunction with the data/video projector to provide secondary displays for those seating positions that cannot easily view the main display.

These displays should be mounted in such a way that their connections and power supply are inaccessible to end users. The aspect ratio and display resolution of flat panel displays should ideally match the aspect ratio of the computer monitor and projector image (if a projector is included in the space). However as almost all large format display panels are manufactured in the 16:9 aspect ratio this is difficult to achieve and therefore care has to be taken as to how images are scaled in mixed display technology systems.

All large format displays installed should have an LED backlight source (no cold-cathode fluorescent lamps) and minimum native resolution of FullHD (1920 x 1080).

Display panels with a soft screen surface should be avoided because of the risk of accidental or intentional damage.

If the use case for a particular space warrants it, then interactive overlay technology can be specified for large format displays. The type of touch technology selected should be given careful consideration and ideally trialled by end users before specifying a particular solution.

3.16 Lecturecast

Lecturecast is the UCL lecture capture and replay service. For ISD supported spaces we attempt to install Lecturecast into all teaching spaces over 30 capacity. If the space is equipped for Lecturecast there will be a number of considerations needed to ensure that recordings made in the space are of maximal use to students. These may include but are not limited to:

- signage to indicate the presence of Lecturecast technology and provide basic guidance on how to utilise it
- a suitable microphone setup (as described in Section 3.08)
- to support Lecturecast a mixed output of audio from the room switcher / DSP needs to be available at a fixed line level, not linked to volume controls in the room but does need to mute with main system.
- a fixed camera that covers a pre-defined presentation area
- a status indicator to show when a session is being recorded with ability to pause and recommence the recording

3.17 Telephone

All teaching spaces should have a working telephone in the proximity of the teaching station. The telephone should ideally be wall mounted (to avoid taking up worktop space on the teaching station) and be able to used in reach of the teaching station controls (so a user can be talked through the process of how to use the facility if they call the ISD Service Desk for help). The telephone should be able to receive incoming calls but should display this via a light rather than an audible ringer.

3.18 Equipment firmware

All device firmware should be the latest release versions available at the time of commissioning and must be consistent across a project. All firmware must be UK regional release.

Copies of the firmware and a reference sheet detailing what versions are installed in which devices should be provided as part of the commissioning package.

3.19 Instructions for audio visual facilities

In all learning spaces with audio visual facilities there should be a set of instructions provided. This should be ideally be in the format of a single laminated A4 card attached to the teaching station via a chain The instruction sheet should be tailored to the specific equipment in the space.

An example of an instruction sheet is contained in Appendix 4.

Instructions for how to contact the support desk should prominently feature on the instruction card.

Whilst instructions could also be provided via the teaching station touch panel it should be recognised that if a user is experiencing

problems operating the equipment via the touch panel controls then providing further information through this interface may not be the most helpful way to support the user.

3.20 Commissioning the facilities

When new facilities are installed into a learning space by external suppliers there should be a documented commissioning and handover/acceptance process.

All functionality of the installation should be confirmed as working and the compliance of the installation with these guidelines checked by a member of the Spaces & AV Team (unless the project is being overseen by another team). If elements of the installation fail these checks then a repeat check scheduled to follow the required remedial works.

The template used for checking installations is contained in 'Appendix 1: Spaces & AV teaching facilities sign off form'

Section 4: Extra small classrooms (< 10 capacity)

These spaces are defined as having movable furniture, flat floors and range in capacity from accommodating 4 students up to 9 students.

4.01 The purpose of an extra small classroom

Extra small classrooms are used by staff and students on more specialised modules or where a larger cohort is taught in subdivided groups. They are also commonly used for tutorial and post-graduate supervision meetings. Students will also utilise unoccupied small classrooms to practice group presentations etc.

4.02 Technology in extra small classrooms

Space is a major constraining factor when specifying the equipment for extra small classrooms. Whilst across all other types of learning space there is an aim to keep the user experience consistent so that staff become confident how to operate the facilities across the whole estate this is not feasible for the small classrooms on the grounds of space.

Assistive listening systems (induction loop system) are not justifiable within extra small classrooms but if a student or staff member identifies the need for this type of system then there are portable systems available with UCL that will work well in this size of space. Loudspeakers and amplifier should be present for programme sound (the replay of sound from recorded and remote sources). Lecturecast is not installed in extra small classrooms as the sessions run should be more interactive than a typical lecture and thus recordings of such sessions are of limited value unless all participants are recorded and this gives rise to various consent issues.

It is acceptable to omit dedicated video playback facilities as most optical video discs can be replayed via the computer resident in the room.

The teaching equipment in extra small classrooms should not intrude into the limited space available and therefore it is recommended that wall-mounted equipment and housings are utilised.

4.03 Layout of extra small classrooms

By the nature of the furniture being movable there will be a degree of flexibility in the layout of the classrooms. However this does not mean that specific design attention shouldn't be paid to the potential layouts achievable with suitable furniture. Guidance illustrations of exemplar layouts with the furniture supplied in the space should be attached to the wall of the space and made available on the room bookings website. Additionally an inventory of the furniture provided in the room should be included so users are aware of what should be present and how to report missing items if appropriate.

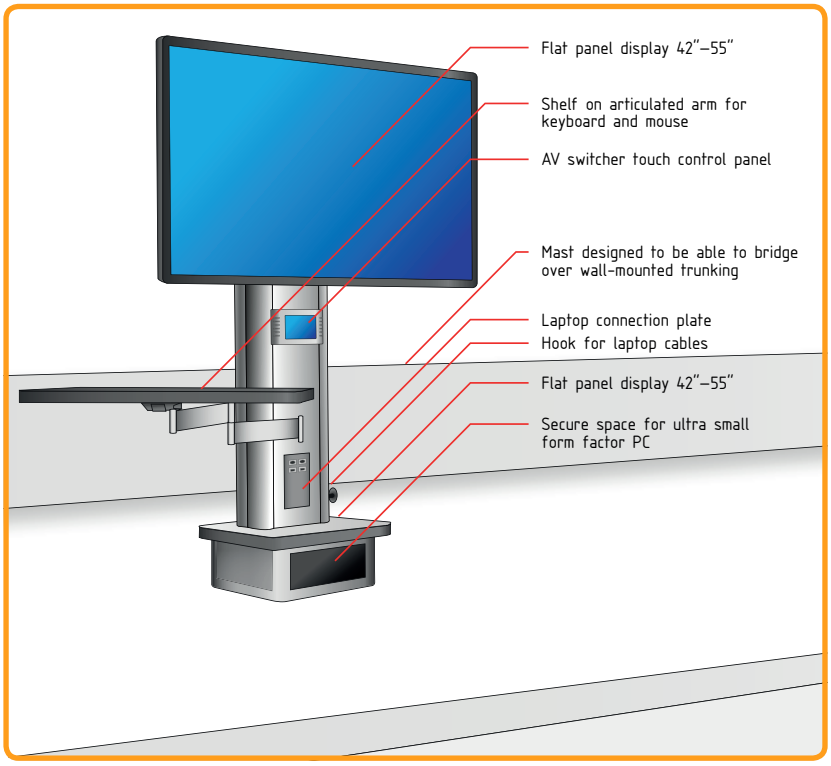
Extra small classrooms may not have enough space to allocate a 'Teaching Wall' and therefore it may be appropriate the use separate walls for electronic display and dry-erase writing surfaces. The layout of the classroom should be such that it is possible to freely walk around the class without disturbing students already seated.

4.05 Display/ writing in extra small classrooms

UCL

In most extra small classrooms there is not sufficient space for any type of installed data projector or teaching station. Therefore the recommended electronic display technology for small classrooms is the large format LCD display.

UCL has a standardised 'mast' solution that can be employed in small classrooms. This solution has been designed to securely accommodate the key equipment whilst minimising the amount of space taken up by the equipment in the room.



above: AV mast solution for small classrooms

A vitreous enamel dry-erase whiteboard should also be provided in small classrooms.

These spaces are defined as having movable furniture, flat floors and range in capacity from accommodating 10 students up to 30 students.

5.01 The purpose of a small classroom

Small classrooms are intended to support a different teaching methodology to that employed in lecture theatres. The following teaching and learning methods are suited for small classroom spaces:

- Inquiry-based learning
- Problem-based learning
- Discussion-based learning
- Student-led interactive learning
- Simulation-based learning

5.02 Technology in small classrooms

The technology within classrooms should closely resemble, but be more limited in capacity, that installed in lecture theatres with common controls interfaces and layouts. Loudspeakers and amplifier should be present for programme sound (the replay of sound from recorded and remote sources) but voice reinforcement or assistive listening systems are not required in this size of space. Lecturecast is generally not installed into classrooms of 10 to 30 capacity as the sessions run should be more interactive than a typical lecture and thus recordings of such sessions are of limited value unless all participants are recorded and this gives rise to various consent issues.

5.03 Layout of small classrooms

Small classrooms tend to have limited space for different layouts but as the furniture is loose this generally gives freedom for the lecturer and students to arrange the room to suit the needs of the learning activity. Ideas of furniture and layouts to suit alternative modes of teaching are contained in the next chapter on 'Medium Classrooms' but many of these solutions could also be used in small classrooms.

Most classrooms will have a primary focus direction where it makes sense to concentrate the teaching facilities and displays. This is often referred to as the 'Teaching Wall'. The layout of the classroom should be such that it is possible to freely walk around the class without disturbing students already seated.

5.06 Projection/ writing in small classrooms

In many small classrooms there is only sufficient space on the teaching wall for a single screen or writing board. Previously the solution of a retractable, pull-down, fabric projection screen in front of a shiny dry-erase whiteboard had been commonly utilised.

This solution had a number of drawbacks:

- projection surface easily damaged by accidentally being written on with dry-erase pen
- retraction mechanism easily damaged through over extension
- downtime of room due to need to regularly replace damaged screens

In light of this an improved solution was developed and this now forms the standard specification used for small classrooms.

This standard comprises:

- a single board solution which can be used for both projection and writing
- an ultrashort throw projector (unless there are site conditions that prevent use of an UST projector)
- worktop mounted visualiser on the teaching station with inset whiteboard surface

The typical layout of this standard classroom is shown in Appendix 3.

A semi-matt vitreous enamel projection board should be used for this purpose and a number of manufacturers make boards to this specification. In these circumstances an Ultra-Short Throw (UST) data projector should be mounted above the board.

The size of the combined function board will typically be 1920mm x 1200mm (16:10 aspect ratio) mounted 1000mm from the floor. If space, and height permits then a larger board, up to the maximum 2400mm x 1500mm supported by the UST projector, should be specified.

If the room size will permit then a separate ‘shiny’ dry-erase whiteboard should be installed alongside vitreous enamel projection surface (which has the UST projector above). Sight lines of both boards should be considered and neither should be given undue prominence through central placement of the other.

UST projectors require a greater amount of ‘headroom’ above the board to accommodate the projector mounting bracket. If there is not the ceiling height available to use a UST projector then a ceiling mounted standard throw projector can be used with a matt projection board (only in rooms where alternative ‘shiny’ boards can be provided alongside, on alternative wall or via column boards. The matt projection surface should display a label notifying users that it is not a writing surface. The specification of this projection surface should be such that if it is accidentally written on then it will not be damaged and the marks can be cleaned off via the use of detergent or solvent agents.

Section 6: Medium classrooms

These spaces are defined as having movable furniture, flat floors and range in capacity from accommodating 31 students up to 50 students. Spaces with capacities over 50 are equipped as lecture theatres.

6.01 The purpose of a medium classroom

Medium classrooms are intended to support the same teaching methodologies as small classrooms (see Section 5.01) but are also particularly suitable for group-based activities because of their larger size.

6.02 Technology in medium classrooms

The technology within medium classrooms should closely resemble, but be more limited in capacity, that installed in lecture theatres with common controls interfaces and layouts. Medium classrooms at UCL are:

- equipped with a standard teaching station with worktop-mounted visualiser
- equipped with Lecturecast
- equipped with boundary microphones for Lecturecast
- equipped with a PTZ camera for Lecturecast
- not equipped with voice reinforcement
- not equipped with assistive listening systems
- not equipped with wearable microphones

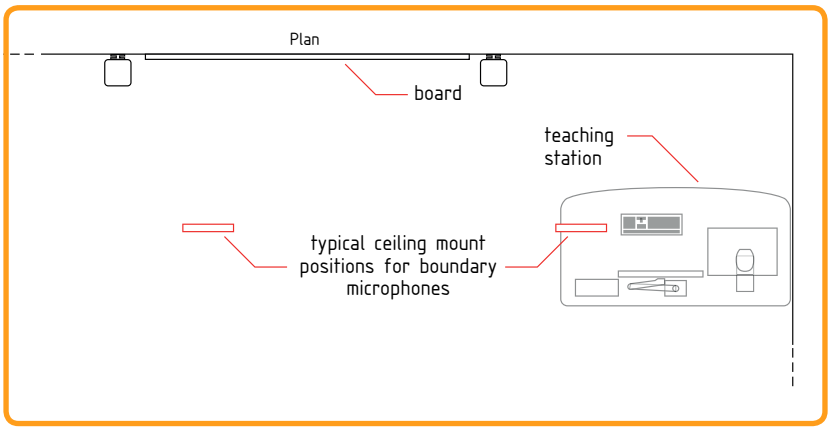
6.03 Lecturecast in medium classrooms

As detailed above, UCL equips classrooms with 31 – 50 capacity with Lecturecast. This entaile a Lecturecast unit, microphones (as detailed below) and a PTZ camera.

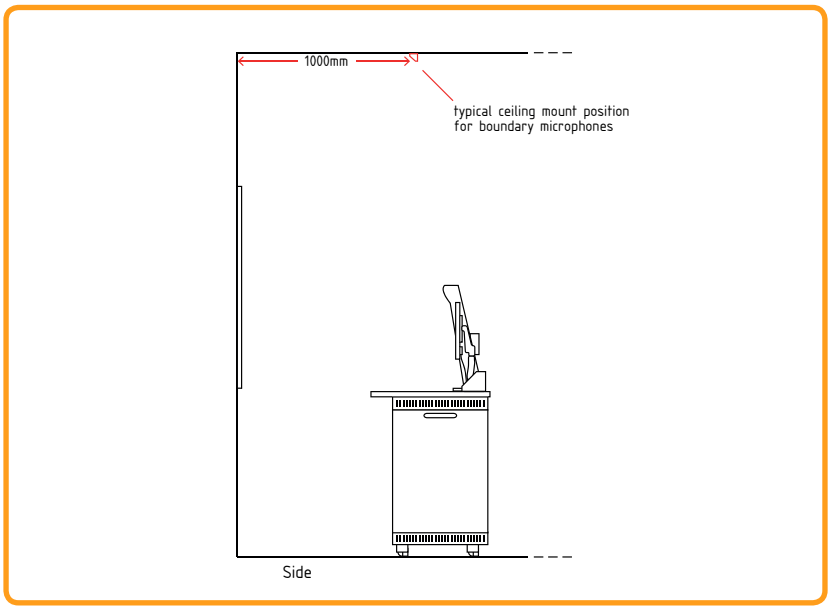
6.04 Microphones in medium classrooms

The sole purpose for microphones in a medium classroom at UCL is to provide voice audio into Lecturecast. As there is no voice reinforcement many users would either not appreciate any reason to wear the microphone or would presume it is not working if they tried it. Therefore for medium classrooms UCL employs a solution is that array microphones with 'corridor characteristic' pickup patterns are installed on the ceiling at 2–3 metre intervals. Typically this will be two microphones positioned at one third and two third positions across the width of the 'teaching zone'. The microphones should be positioned between 1000mm and 1500mm from the wall/board surface so that the pickup area is biased in favour of the presenter rather than the audience. These microphones should have balanced signal cables to minimise the possibility of cable induced noise and should be phantom powered (48V) by the equipment within the rack. Suitable microphones are available in white finish to minimise their visual conspicuity.

Suitable microphone models are specified in Appendix 3: UCL standardised equipment list



above: plan view of typical positions for boundary microphones



above: section view of typical positions for boundary microphones

The primary advantage of this microphone solution is that it does not require the user to understand how to operate any microphone and is not dependent upon either a rechargeable battery being charged or non-depleted disposable batteries being present.

Installation of gooseneck microphones on the teaching station should not be necessary and should be avoided as they encourage static lecturing styles and potentially cause uneven sound levels if the lecturer does move in and out of its pickup zone.

It is conceivable that there may be classrooms where microphones are required but that it is not practicable to install ceiling mounted boundary microphones. In these circumstances it would be advisable to install wearable microphones as per a lecture theatres (see Section 8.06).

6.05 Projection/ writing in medium classrooms

In medium classrooms there should be sufficient space on the teaching wall to accommodate both a rigid projection screen and at least one writing board.

When a ceiling-mounted standard throw projector is used the projection suface should be a matt finish projection board. The matt projection surface should display a label notifying users that it is not a writing surface. The specification of this projection surface should be such that if it is accidentally written on then it will not be damaged and the marks can be cleaned off via the use of detergent or solvent agents.

Where shiny vitreous enamel boards are fitted alongside the projection surface it can be advantageous to also fit a glide rail board so that additional writing area is available if the lecturer does not require to display a projected image.

6.06 Layout of medium classrooms

By the nature of the furniture being movable there will be a degree of flexibility in the layout of medium classrooms. However this does not mean that specific design attention shouldn't be paid to the potential layouts achievable with suitable furniture. Guidance illustrations of exemplar layouts with the furniture supplied in the space should be attached to the wall of the space and made available on the room bookings website. Additionally an inventory of the furniture provided in the room should be included so users are aware of what should be present and how to report mi ssing items if appropriate.

Most medium classrooms will have a primary focus direction where it makes sense to concentrate the teaching facilities and displays. This is often referred to as the 'Teaching Wall'. The layout of the classroom should be such that it is possible to freely walk around the class without disturbing students already seated.

6.07 Medium classroom furniture

The furniture utilised in medium classrooms will vary according to need and the parameters of the rooms but below is a list of commonly used furniture:

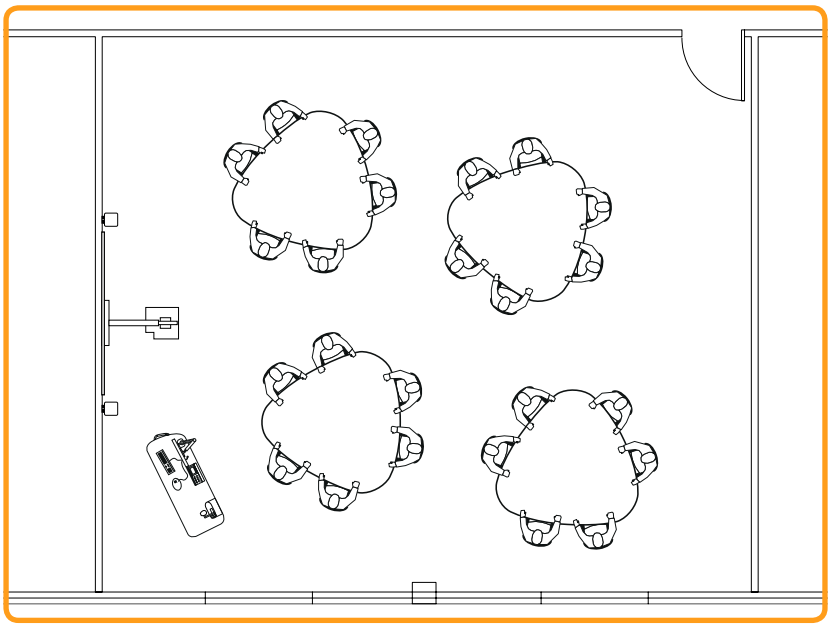
- Standard light weight table with option for casters
- Flip-top table on casters
- Plectrum and other non-standard shapes.

In order to facilitate the flexibility desired flip-top or easily stackable tables have been specified in our procurement framework.

above: illustration of typical flip-top table

Flip-top table are recommended for use in medium to large flat spaces where conversion to open space is required often. The tables nest to the side of the space and are easily manoeuvrable.

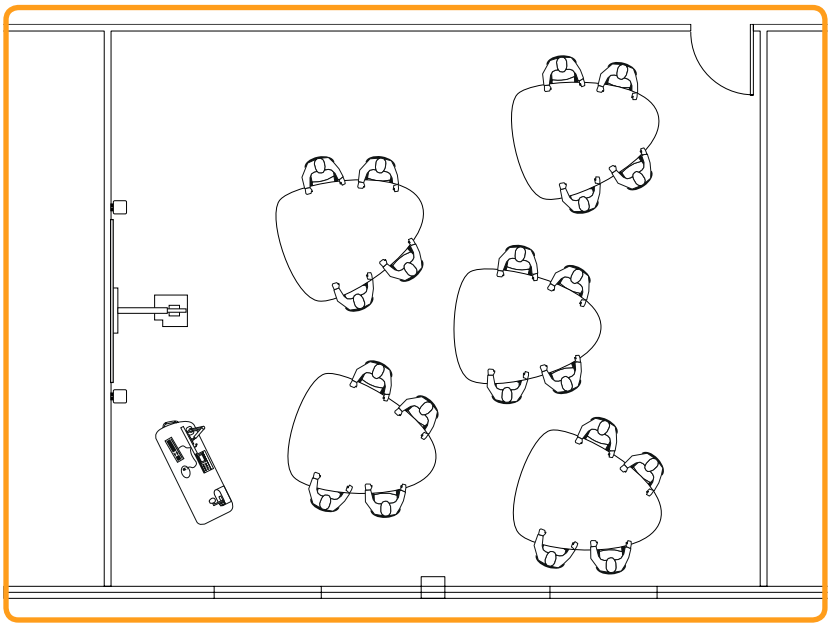
Where there is the desire to create a learning space that is more conducive to group/collaborative/problem-based pedagogies then consideration should be given to ‘plectrum’ shaped tables. They can nest by stacking but in most cases the space would stay as set.



above: illustration of equilateral plectrum tables

Whilst equilateral plectrum tables maximise (equally to circular tables) collaboration opportunities they are not ideal when elements of the session are ‘face-forward’. Non-equilateral plectrum tables, especially when the capacity expection of the space is realistic and permits keeping the wide end of the table un-occupied, offer

clearer sightlines whilst maintaining the collaborative affordances of plectrum tables in general.



above: illustration of non-equilateral plectrum tables

Some consideration needs to be given to the percentage of spaces used for exams and furniture that enables both exams and general usage will be required in certain spaces.

The dimension of classroom tables should balance the need to maximise occupancy but provide a sense of adequate quality worktop space. Worktop surface should in general be between 300mm and 600mm deep but consideration should be given to the use of 'plectrum style' layouts on a case-by-case basis.

If a space is to not have tables, either for capacity or design reasons, then chairs incorporating a tablet work surface should be utilised. Ideally the tablet surface should be able to be used by right or left-handed people without having to modify/dismantle the chair. Some designs offer bag storage underneath the chair.

above: chair on casters with tablet surface and bag storage

When selecting chairs to accompany tables in a classroom they should be:

- Stackable
- Available with or without casters
- Available with an arm option (min of 5% within a classroom should have arms for inclusivity)
- Available with upholstered seat pads and either upholstered or soft plastic back rest

above: example of lightweight stackable classroom chair

Section 7: Small Lecture Theatres (< 50 capacity)

7.01 The purpose of small lecture theatres

UCL is atypical in the sector in that it has seven smaller capacity, i.e. less than 50 people, teaching spaces with fixed position seating. These spaces are booked as 'Lecture Theatres' but it can be assumed that a wider range of teaching methodologies takes place in them than what would normally be categorised as 'lecturing'.

For examples of teaching methodologies beyond lecturing that may take place in these small lecture theatres please refer to Section 5.01.

7.02 Technology in small lecture theatres

The technology within small lecture theatres should closely resemble that installed in larger lecture theatres with common controls interfaces and layouts. Audio reinforcement and assisted listening systems (induction loop systems) are unlikely to be needed or installed. Speakers and amplifier should be present for programme sound. Lecturecast is not currently installed in any of the sub-50 capacity lecture theatres but as Lecturecast is rolled out further it is likely that some of these small lecture theatres will have the system installed. When this arises the microphone solution specified for classroom (Section 6.04) would be recommended.

7.03 Layout of small lecture theatres

By the nature of the furniture being fixed there is less flexibility in the layout of these small lecture theatres. The positioning of the teaching station is critical to ensure the lecturer can face the students whilst operating the teaching equipment and not be obstructing the student's view of presented materials. If there is insufficient space to accommodate the teaching station facing the students due to lack of available space the result may be that the teaching station needs to be positioned perpendicular to the student benching/seating.

7.04 Projection/ writing in small lecture theatres

If space permits then the solution of column-mounted whiteboard panels in front of a dedicated projection screen should be utilised. If there is not adequate space for this solution then the same logic for selecting the projection/writing surfaces in medium classrooms (Section 6.05) should be employed.

These spaces are defined as having fixed seating and vary greatly in capacity. Larger examples often have raked floors to improve the view and audibility for students.

8.01
The purpose of a lecture theatre

There have been significant shifts in what is recognised as good teaching practice and nowhere is there more controversy and resistance to change than in the conception of the large lecture. However a number of contributory factors have made many academics question the validity of verbally delivering content to hundreds of students packed into passive rows. These factors include:

- the technological alternative methods for 'conveying' content (VLE, podcasts, 'flipping the lecture', personal lecturecasting)
- increased expectation from fee-paying students that their learning experience will be engaging and not passive
- greater student numbers without corresponding increase in resources and increasing capacity pressures put upon University estate
- abundant research published on more effective methods of teaching
- technology such as Electronic Voting Systems that permit the large scale face-to-face sessions to be much more interactive and discursive therefore exposing the comparatively limited effectiveness of didactic lecturing and the inherent problems of using a traditional lecture theatre for any different mode of teaching that diverges from the one for which it was designed
- ubiquity of web connected mobile devices enables learners to simultaneously cross-reference or contextualise what the lecturer is presenting resulting in a change of the expertise dynamic and increased tendency to encourage discussion within the session
- ability for students to attend the live session virtually by means of synchronous online collaboration tools or live lecturecast streaming
- ability for students to 'skip' the live session and 'catch up' via the lecturecast recording – after all if the lecture is a passive experience for the student then passively watching a recording would an equal value experience

This questioning of the role of the traditional lecture would need to inform the design of any new teaching space developments. However where an existing lecture theatre is being refurbished there may also be scope to consider adjustments that would better future-proof the space.

8.02 Seating

UCL

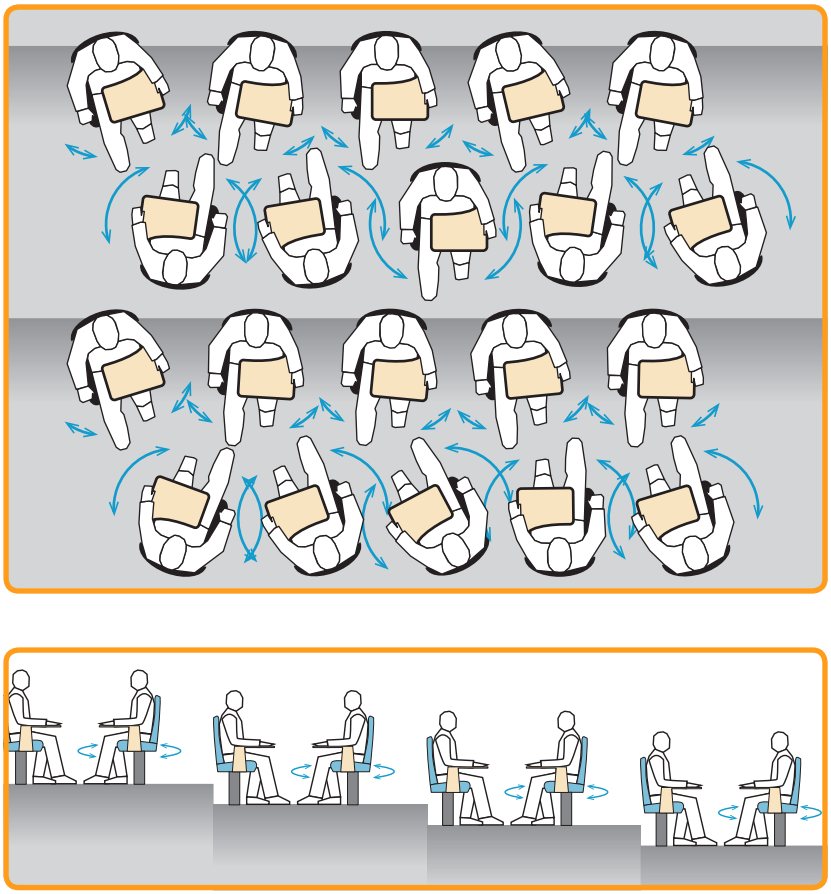
Reference

Iowa State University case study:
http://net.educause.edu/ir/library/pdf/P7102cs9.pdf

The traditional layout of the audience seating in lecture theatres is long, single rows with one row of seats per tier in raked spaces. Rows are either straight or curved with the intention of keeping the individual seats orientated to the teaching focus of the space. Seats either have a fold-out note-taking surface or are behind shallow fixed desking.

In future consideration should be given to alternative layouts.

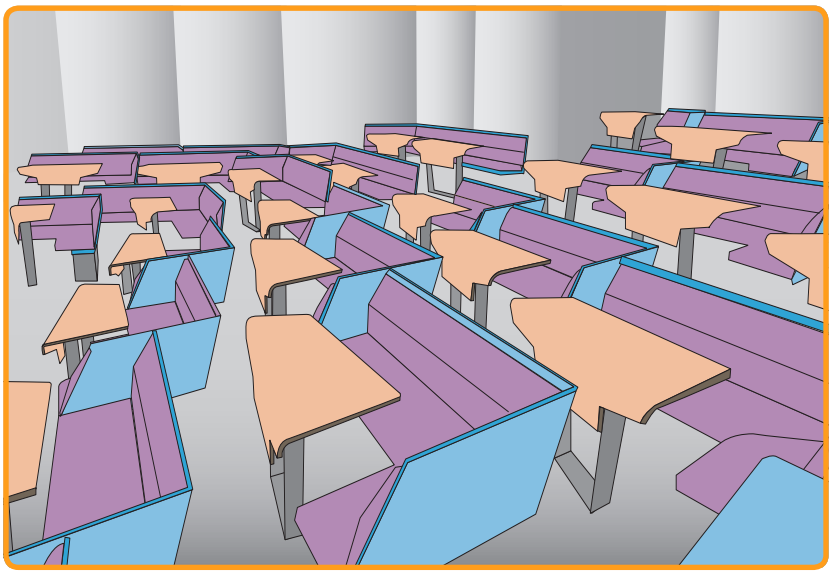
One layout idea that has been seen at other institutions (Exeter and Iowa State) is to provide alternate rows of seating that can be rotated to facilitate the small group discussion that is now common in sessions that are seeking to be more active and engaging.



above: example lecture theatre layout with rotating seating

If this type of seating is to be included specific attention needs to be given to the relative positioning of the seats. Errors that can be made include positioning both front and rear seats on a particular tier in direct alignment obscuring the view of the rear seat occupant. Another error, that has been seen in a lecture theatre of this design at another institution, is insufficient space between the two rows on the same tier which results in occupants being uncomfortably close when in discussion mode.

Another, more interesting design, goes one step further and gets the students to sit in groups from the outset. This design, seen at Loughborough University, also has the benefit of giving each group a large enough shared table space that small scale group practical task and/or object-based learning can be practised.



above: example lecture theatre layout to support small group work

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. Upholstery should be chosen for durability and longevity. Lecture theatre seating should come from an ISO9001 accredited manufacturer. Each space shall consider if occupancy or flexibility can be improved upon in the design - for all categories the criteria will include:

- potential to retract seating.
- potential to create section of seating that can swivel to facilitate collaboration
- potential to divide larger spaces into smaller spaces

In all lecture theatres, with the assumption that all lecture theatres will be wheelchair-accessible, there should be provison for wheelchair users to partake in the lecture whilst in their chair. The number of these spaces should be proportionate to the total number of seating positions.

Fire and emergency guidance relating to the design of fixed lecture theatre seating is given in the UCL Fire Safety Technical Notes & Mandatory Instructions:
http://www.ucl.ac.uk/estates/maintenance/fire/documents/

8.03 Student working surfaces

Each student seat should be provided with a horizontal surface suitable for use when taking notes or using a small portable electronic device.

If the working surface is to be provided via the use of a fold out attachment to the seat then these should either be left/right swappable by the user of a 10% ratio of seats are to be provided with left-handed surfaces. The distribution of these 10% of surfaces should be designed such that their location is clear to users, for example the left-hand end of rows would be a suitable location.

Working surfaces should not have any raised lip around their edge, should be made/covered in a material that provides a non-slip surface but that is not overly textured.

Working surfaces should have minimum dimensions of 300mm by 300mm.

8.04 IT and power provision for students

IT provision for students in lecture theatres is minimal but as per Section 2.08 the Wi-Fi infrastructure in the space should be designed to accommodate a number of concurrent connections of 5x the maximum number of people expected to occupy the space at any one time.

Students have specified that they value access to power sockets in learning spaces. However as mobile devices have ever-increasing battery capacities, currently many devices have all-day batteries, it is uneconomic and unjustifiable to specify power outlets to every seating position.

A compromise arrangement is to fit power provision to only a proportion of the seat positions. A recommended approach is to fit power provision to only the first two rows of seating in lecture theates as these are typically the least favoured by students. Selecting these rows has the dual benefit of ensuring that those who need the sockets can get to them as well as generally encouraging the students to sit closer to the lecturer.

To reduce the cost and complexity it is advisable to explore with the electrical contractor the possibility of installing an A3 20A radial circuit for these power outlets. The *'Requirements for Electrical Installations IEE Wiring Regulations – BS 7671:2008'* have previously limited the areas this type of circuit can be installed within to <50m^2 but the July 2008 Corrigendum to the Seventeenth Edition demotes this restriction to 'historical' and therefore provided volt drop, disconnection time and likely load considerations are met there are no limits to floor area or socket numbers.

In addtion to provision of BS1363 power outlets it is desirable to provide inbuilt USB charging facilities for students using tablets and other small mobile devices that can be charged via USB. Typically small mobile devices require a 0.5A charge current but tablet computers such as Apple's iPad require a 2.1A charge current.

A number of manufacturers offer recessed socket outlet panels that can be fitted into desking. Caution should be used in assessing the merits of these systems and special consideration given to the additional risks posed by sockets mounted in the horizontal plane where there is the potential of accidentally spilt fluids.

8.05 Teaching Stations in large lecture theatres

Teaching Stations in larger lecture theatres should be operationally consistent with those in classrooms but will generally be larger. Since 2016 UCL has fitted ceiling-mounted visualiers above a height adjustable teaching station with an inset writing surface (see Section 3.08 for an illustration.

7.06 Microphones in large lecture theatres

Large lecture theatres typically have voice reinforcement, assistive listening and lecture capture systems and therefore they also have the requirement for high quality voice pickup by microphone.

The high ceiling height in most lecture theatres precludes the use of ceiling mounted array microphones and therefore the default solution is to provide a wearable radio microphone.

In large lecture theatres there should be four wearable microphones provided. The logic for providing four microphones is that there is less chance of finding the internal batteries of both microphones depleted and the provision of multiple microphones better supports team teaching and/or passing a microphone to students for discussion activities.

The brand and model of microphone specified should be simple to operate and the appropriate operation steps for using the microphone should be included in the teaching station instructions (see Section 3.14).

In the largest lecture theatre spaces, which are often used for mass meetings and events, it is desirable to have additional handheld radio microphones available that can be passed into the audience for pickup of questions/comments.

Across all these spaces there should be an additional single array microphone installed on the teaching station. This microphone will provided a 'fallback' audio pickup in the event that the users forget or don't understand the need to use the wearable microphone(s) or the microphone batteries are not sufficiently charged for use. However it should be noted that an array microphone on the teaching station only provides effective pickup if the presenter remains in close (< 2 metre) proximity to the teaching station.

Installation of gooseneck microphones on the teaching station should not be necessary and should be avoided as they encourage static lecturing styles and potentially cause uneven sound levels if the lecturer does move in and out of its pickup zone.

8.07 Projection/ writing in large lecture theatres

One challenge in larger spaces is facilitating a method for the instructor to write/illustrate and those markings 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 expand this workable height as the lecturer can easily raise a board to make it more visible to students whilst continuing to write on second board below.

In the larger lecture theatres the legibility of material written/ illustrated on vertical writing surfaces is constrained for the students furthest from the front by the limit of scale that it is possible to write at with natural fluidity.

Technology can provide solutions to this issue in the following ways:

- use of visualiser as a horizontal writing surface
- use of touch sensitive fixed display monitor (for example Smart Sympodium)
- use of an interactive whiteboard with its display duplicated onto larger projection surface

- use of a portable tablet device with its display mirrored onto larger projection surface (possibly via the fixed teaching station PC)

Evaluation of the advantages and drawbacks of each of these technologies will form a focus for upcoming research by E-Learning Environments to inform the future revision of this document and define the convergence onto a single solution for this issue.

Notwithstanding the technological solutions outlined above, and the likelihood that one of those will become the future recommendation, the most common solution currently utilised in large lecture theatres is column-mounted boards in front of a projection screen. This solution has proved reliable and is an acceptable current solution for refurbishments of lecture theatres. However where space permits additional whiteboard surfaces should be put alongside the main projection surface as many lecturers want to be able to simultaneously project an image whilst drawing or writing on another surface.

Section 9: Computer Cluster Rooms

These spaces are defined as having desktop PCs.

9.01 The purpose of a computer cluster room

Computer cluster rooms are intended to support some or all of the following three 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 cluster rooms perform all these functions at different times whereas some are only used as 'Open Access' facilities and are not bookable for teaching purposes.

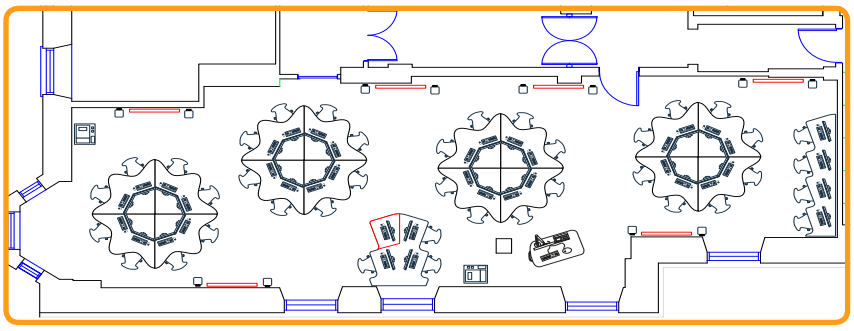
9.02 Technology in computer cluster rooms

The teaching technology within computer cluster rooms that are bookable for teaching should closely resemble that installed in lecture theatres and classrooms with common controls interfaces and layouts. 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 HVAC required in rooms with many computers. Lecturecast is not likely to be installed in computer cluster rooms as the sessions should be making use of the computer facilities provided to each student and thus if recordings of screen-based demonstrations are required these should be produced out of the session time.

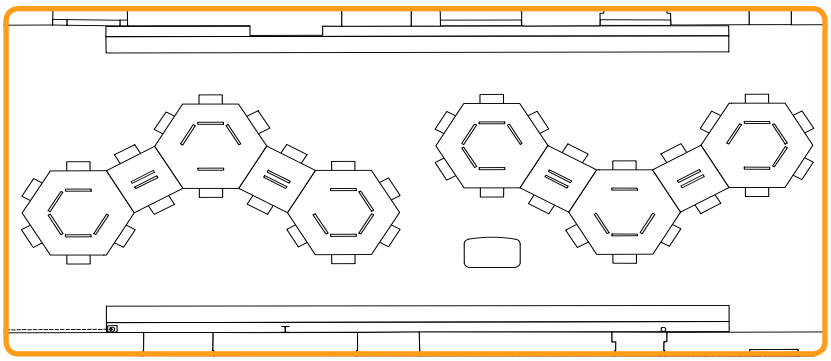
In computer cluster rooms that are used for taught sessions there should be a distinct teaching position. Where space permits this should be a standardised teaching station as described in Section 3. Given the visual obstruction between the learners and the instructor caused by the monitors/computers it is desirable that the teaching station in this type of room is height adjustable. A visualiser is unlikely to be needed in a computer cluster room and thus should not be installed unless there a known specific need in the space.

9.03 Layout of computer cluster rooms

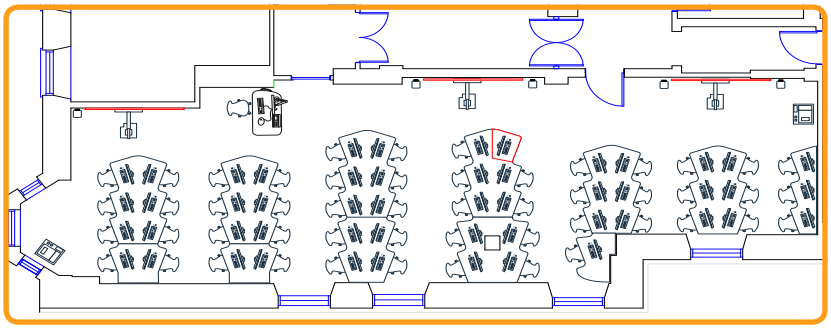
Many of the existing computer cluster rooms are densely packed which provides little opportunity for collaborative learning and makes circulation around other users in the space difficult. Although accommodating the maximum number of workstations in a space is often a priority, the assumption that the density achieved with straight rows is much greater than any other layout should be questioned and alternative layouts investigated.



above: example of a 'petal table' cluster room layout



above: example of a ‘hexagon table’ cluster room layout



above: example of a ‘jagged edge table’ cluster room layout

The example layouts given here are not shown as templates to be reapplied but instead as examples that suited the particular usage contexts, needs and dimensions in those spaces and may provide inspiration for future work.

9.04 Design of computer workstations

The physical setup of each computer workstation should aim to ensure both the comfort of the user and, as much as possible, that the user is in the correct ergonomic posture so as to minimise the risk of computer induced medical problems.

Design and dimensions of computer workstations in offices are legislated through the European Display Screen Equipment Directive (90/270/EEC) but there is no specific legislation for the context of students in learning spaces.

A single BS1363 power socket outlet should be provided at worktop level per position so that the student can plug in a personal device without reaching under the worktop and accessing the outlets that are supplying the desktop computer.

Computer monitors (or the whole computer if an all-in-one unit) should be mounted in such a way to facility easy tilt and height adjustment of the display by the user.

Chairs should be standard rotatable, caster-mounted and adjustable to the preferences of the user.

Dimensions for workstations should comply with British Standard EN 527-1:2011 which is available to UCL members via the library database directory.

Reference

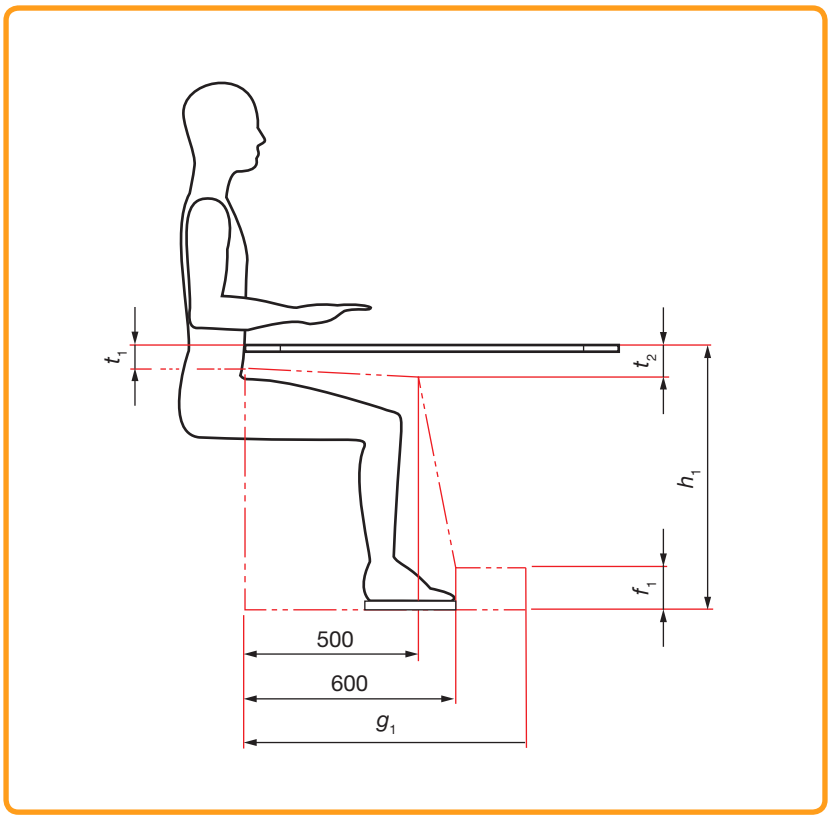
http://www.hse.gov.uk/pubns/priced/l26.pdf

Further guidance

See Appendix 5 for UCL Desk Standards for Teaching and Learning Spaces (cluster rooms)

Dimensions			Work table/desk type						
			Type A	Type B	Type C	Type D			
			Fully Adjustable	Fully selectable	Fixed height	Limited adjustable or limited selectable [e]			
h_1	Height of work surface	Sitting only	Minimum range 650—850	Minimum range 650—850[a]	740 ± 20	-allow	Min	Max	+allow
						yes	680	760	yes
		Standing only	Minimum range 950—1250	Minimum range 950—1250	1050 ± 20	-allow	Min	Max	+allow
						yes	1000	1180	yes
		Sit/Stand	Minimum range 650—1250	N/a	N/a	Minimum range 680—1180			
t_1 and t_2	Maximum desk top thickness	At the front, t_1	55[b]	55b	70	70			
		At 500 mm from the front edge, t_2	80[b]	90[b]	100	100			
k_1	Minimum height of knee clearance for standing position only	Applies only to tables with a height more than 850 mm	700[d]	700[d]	700[d]	700[d]			
k_2	Minimum depth of knee clearance for standing position only		80	80	80	80			
k_3	Minimum depth of foot clearance for standing position only		150	150	150	150			
f_1 and f_2	Minimum height of minimum foot clearance	Sitting only and sit/stand From 600mm to 800mm from the front edge, f_1	120	120	120	120			
		Standing only	120	120	120	120			
g_1	Minimum legroom depth [c]	Sitting only and sit/stand	800	800	800[f]	800			
D	Minimum desk top depth[9]		800	800	800[f]	800			
W	Minimum legroom width	Sitting only and sit/stand	1200	1000	850	850			
		Standing only	790	790	790	790			

Below is key information from BS EN 527-1:2011.



above: BS EN 527-1:2011 seated posture

9.05 Computer considerations

The choice of computer form factor should be considered in respect to both the aesthetics of the space and the possible negative impact of locating the base unit and security cage under the desk. Large form computer base units located under desks can impinge on leg room when there is a single user but also discourages student collaboration and co-working where two students attempt to sit at a single computer.

Historically the life expectancy of the computer base units was dictated both by the expected electronic reliability/length of warranty support and the period for which the performance of the processor is considered acceptably current and is able to support current software requirements. Typically this has been less than five years.

Since the introduction of widescreen LCD monitors there has been little in the way of evolution of monitors. Now that many LCD monitors have LED backlighting the life expectancy should be greater than previous generations (which tended to go dim after four or five years).

Reference

Dell Energy Savings Calculator

http://www.dell.com/content/topics/topic.aspx/global/products/landing/en/client-energy-calculator

Given the life expectancy of the computer base unit and monitor are comparable now preference should be given to the adoption of ‘all-in-one’ form factor computers. Typically these provide a cleaner look, with less cabling to conceal (or fail) and are significantly more energy efficient.

All-in-one computers should be installed by mounting them to the desk on an adjustable, spring-balanced, arm with security fixings to prevent unauthorised removal.

9.06 Technology touch down points

As more students bring their own portable devices onto campus the University should consider how these students would benefit from facilities to support their use of these devices. It has been observed that many students choose to use their own devices within computer cluster rooms which can be attributed to the following reasons:

- they are wanting to work in proximity to peers who are doing similar tasks on the provided workstations
- they are wanting to use the multifunction device in the room
- there is no other suitable quiet space to work in

However most existing cluster rooms provide no facility for students to use their own devices. In future redevelopments of PC cluster rooms consideration should be given to including specific 'Technology touch down points'. These are positions where there is space to sit and work at a laptop computer.

There should be two BS1363 socket outlets at the desk height but care needs to be taken to ensure they are not mounted in such a way that prevents insertion of block type power adaptors that extend beneath the socket (a common mistake if the socket plate it mounted in the vertical plane directly on top of a horizontal desk surface). Additionally USB power outlets capable of detecting devices requiring higher power (e.g. iPad which requires 2.1A)

Incorporating a typical 21" widescreen monitor on an adjustable arm above this desk space would add value and comfort for those using their own devices in these spaces. Monitors provided for this purpose should have multiple connectors (VGA and HDMI) on flying leads to the desktop.

9.07 Multifunction devices

The UCL standard multifunction device enables students to scan, print or copy from a variety of devices. Depending on the size of the cluster room there will be either a single or multiple multifunction devices.
When multifunction devices are present special attention should be paid to the storage of paper and printer consumables. Cupboards should be provided for these materials near the location of the multifunction device as should paper recycling collection bins.

Spaces & AV teaching facilities sign off form –
Building:
Room:
AV Integrator:

Date of visit:
Form completed by:
Personnel present:

Section 1 Physical Checks

Section 1.1: Items and Quantities of Installed Equipment

				Description of issue(s)	Remedial actions required
AV equipment supplied and installed as per agreed specification (check against mini-comp/quote/PO as appropriate)	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 1.2: Teaching Station

				Description of issue(s)	Remedial actions required
Specification - Correct Overall Dimensions? - Correct Finish & Component Materials? - Correct Branding - Absence of integrator branding? - Correct Rack provision (RU)? - Correct Manufacturer supplied power provision (if applicable) - Correctly provided Castors / Feet / Floor to Rack Bracket as per specification	Pass ☐	Fail ☐	n/a ☐	1.	1.
Position - Teaching station aligned with ceiling camera? (if appropriate) - Correct orientation in room?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Internal Cable Management - Tidy rack cabling? - Correct bend radiuses? - Appropriate cable fastening? *(CAT cables velcroed, not cable-tied))* - Correct Cable numbering? - Correct cabling grouping (mains separate from signal)?	Pass ☐	Fail ☐	n/a ☐	1.	1.
External Cable Management - Floor box lids closed? (if applicable) - Is umbilical suitable length to sit flat on floor (if applicable) - Are cables suitably grouped within unmbilicals - if fitted, are disconnectable wall terminations suitably labelled on both the plugs and wall plates? - If specified is Anchor Chain installed to prevent cable damage?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Security - UCL Suited Keys? - For all accessible fixings are they of the Anit-Tamper type?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Motorised Movable Components - Correct motion? - Correct limits set? - Free movement unrestricted by cable pathways?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Confidence Monitor Arm - Fixed Securely? - Freely movable / Restrictive Cabling? - Cable routing and management?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Touch Panel Fixing - Fixed Securely? - Secured into housing? - Housing fixed to worktop?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Mic Charging Base - Base mounted in correct position? - Charging Base securely mounted to surface with industrial Velcro?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Input Plate Housing - Input plate fixed securely to housing? - Housing mounted in correct position?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Input Plate - Do inputs presented reflect system schematic? - Permanently labelled/engraved?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Flying Leads - Suitable length VGA with attached 3.5mm connected - Suitable length HDMI connected	Pass ☐	Fail ☐	n/a ☐	1.	1.
User Power Provision - Correct installation location?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Embedded Writing Surface - Correct size and position in surface? - Free from dents?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 1.3: Input Devices

				Description of issue(s)	Remedial actions required
Optical Disk Player - Installed in accessible location? - Drawer and eject button not in obstructed location? - Securely fixed into rack?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Resident PC - Installed in accessible location? - Drawer and eject button not in obstructed location? - Front panel USB sockets not in obstructed location? - Securely fixed into rack? - Keyboard and mouse connections made to rear of PC (not front)? - Mouse can be used in both RH and LH configurations (check for over-zealous cable tying)?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Document Camera/Visualiser *For ceiling-mounted versions* - Installed in correct location? - Aimed correct (e.g. directly down for EYE12)? *For worktop versions* - Installed in correct location? - Embedded into worktop or securely mounted? - For embedded versions check for excessive movement of the unit in the worktop.	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 1.4: Microphones

				Description of issue(s)	Remedial actions required
Wearable Microphones - Two wearable microphones in charging dock? - Neck lanyards attached?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Boundary Microphones - Correct number of boundary microphones installed? - Correct postions? - Correct orientation?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 1.8: Induction Loop

				Description of issue(s)	Remedial actions required
Induction loop - Loop tails robustly connected to rack location? - No loop tape left exposed?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 1.9: Lecture Capture

				Description of issue(s)	Remedial actions required
Lecturecast unit - Correct connection of presentation and camera feed to correct inputs as per design specification? - Installed in location accessible to end users?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 1.10: Projection and Writing Surfaces

				Description of issue(s)	Remedial actions required
Fixed Projection Screens - Installed in specified locations? - Correct dimensions and surface as per design specification - Flatly mounted to wall (check for distortion of boards which are screwed to unflat walls) - For WetWipe screens has the manufacturer's instructions sticker been removed (it should be)? - For WetWipe screens "Do not write on this projection board" applied?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Retractable Projection Screens - Installed in specified locations? - If motorised, has the correct control as per design specification been installed - For manually retracted screens, does the mechanism work smoothly and without snags?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Writing Boards - Installed in specified locations? - Correct dimensions and surface as per design specification? - Transit film removed?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Column Boards - Installed in specified locations? - Correct dimensions and surface as per design specification? - Correctly counterweighted? - Smooth motion?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Glide Rail Systems - Installed in specified locations? - Correct dimensions as per design specification? - Smooth motion? - Correct standoff? - No obstructions to movement?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 1.11: Variants of standard equipment

				Description of issue(s)	Remedial actions required
TurningPoint *Appropriate only to UCL main lecture theatres* TurningPoint receiver connected to rear of resident PC	Pass ☐	Fail ☐	n/a ☐	1.	1.

IWB functionality *Appropriate only to type A or other rooms with interactive UST projectors* USB connection between Resident PC and IWB unit? Infrared curtain box corectly installed and aligned (if appropriate)?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 1.12: Non-standard room specific equipment (e.g. Video Conference Systems, manually controlled PTZ Camera)

				Description of issue(s)	Remedial actions required
item:	Pass ☐	Fail ☐	n/a ☐	1.	1.
item:	Pass ☐	Fail ☐	n/a ☐	1.	1.
item:	Pass ☐	Fail ☐	n/a ☐	1.	1.
item:	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 2 Control System Program Implementation and Function

				Description of issue(s)	Remedial actions required
UCL standard programme base utilised - No 'artisitic licence' taken with GUI? - Standard colour schemes used	Pass ☐	Fail ☐	n/a ☐	1.	1.
Start-up and Shut-down timers - Appropriate duration for projector(s) installed?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Terminology in GUI - Correct terminology for environment (for 2016 the IOE rooms should not refer to 'Desktop@UCL' nor 'UCL username and password' – should be 'PC' and 'Valid username and password'	Pass ☐	Fail ☐	n/a ☐	1.	1.
AV System Wake - Welcome screen touched / Energy saver off >> Display of interface home screen on touch panel	Pass ☐	Fail ☐	n/a ☐	1.	1.
Correct Input Buttons displayed - Are the input buttons correct for the hardware and input plate in the room?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Inputs correctly named on switcher - When switching input the switcher OSD should display the same name as the Crestron button	Pass ☐	Fail ☐	n/a ☐	1.	1.
Displays on - Any input selected on interface home screen >> Projector and/or panel displays to power up. If integration to room lighting system applicable to room then switch to lighting state 2	Pass ☐	Fail ☐	n/a ☐	1.	1.
Image Blank - Image Blank button on interface screen pressed >> All audience-facing display devices are set to 100% black. Display to lectern confidence monitor remains on currently selected input If integration to room lighting system applicable to room then switch to lighting state 1 (all on)	Pass ☐	Fail ☐	n/a ☐	1.	1.

Image Reveal - Image Reveal button on interface screen pressed >> All audience-facing display devices show current source. If integration to room lighting system applicable to room then switch to lighting state 2	Pass ☐	Fail ☐	n/a ☐	1.	1.
Shutdown - Shutdown button on interface screen pressed >> Shutdown confirmation or cancel screen displayed on touch panel	Pass ☐	Fail ☐	n/a ☐	1.	1.
Shutdown confirmation positive - Second Shutdown button on confirmation interface screen pressed >> System put into power saving standby state (display devices switched into standby mode). Routing to lectern confidence monitor set to display resident PC. If integration to room lighting system applicable to room then switch to lighting state 1 (all on)	Pass ☐	Fail ☐	n/a ☐	1.	1.
Shutdown confirmation negative - Cancel Shutdown button on confirmation interface screen pressed >> Returns to state as before entering Shutdown confirmation interface	Pass ☐	Fail ☐	n/a ☐	1.	1.
Input selected (all) - Any input selected by user >> Input displayed to audience facing displays and lectern confidence monitor	Pass ☐	Fail ☐	n/a ☐	1.	1.
Laptop - Laptop input selected by user >> Choice of VGA or HDMI presented	Pass ☐	Fail ☐	n/a ☐	1.	1.

Bluray page - Bluray input selected by user >> Bluray output displayed to audience facing displays and lectern confidence monitor. Functional core Bluray player controls displayed on control panel.	Pass ☐	Fail ☐	n/a ☐	1.	1.
DocCam page - DocCam input selected by user >> DocCam powers up and output displayed to audience facing displays and lectern confidence monitor. Functional DocCam controls displayed on control panel inc Zoom In/Out, Autofocus toggle, Focus In/Out and light controls where appropriate.	Pass ☐	Fail ☐	n/a ☐	1.	1.
Lighting Controls - 4 x lighting preset buttons (1=Full, 2=Projection, 3=Movie, 4=All Off) >> Appropriate lighting states recalled (see UCL Learning Space Guidelines).	Pass ☐	Fail ☐	n/a ☐	1.	1.
Tech Page (if appropriate) - After initial Shutdown depress >> Option for Tech Page. Check functionality on Tech Page.	Pass ☐	Fail ☐	n/a ☐	1.	1.
Technician Second Control Panel (if appropriate) - Check full functionality on Second Technician Panel.	Pass ☐	Fail ☐	n/a ☐	1.	1.
Other comments on programme (if appropriate) - e.g. Unexpected behaviours	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 3 Operational Checks

Section 3.1: Main input sources

				Description of issue(s)	Remedial actions required
Resident PC - Log into Resident PC successful? - Display of resident PC at correct resolution and aspect ratio on all displays? - Audio replay from PC successful?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Laptop - Laptop via VGA display successful? - Laptop via VGA audio successful? - Laptop via HDMI display & audio successful?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Laptop Resolution - Is the EDID set right (laptop is not forced into a too low resolution)?	Pass ☐	Fail ☐	n/a ☐	2.	2.
Bluray - Test disc display successful on both main display and confidence monitor? - Operate disc control via panel buttons successful?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Doc Cam - Doc Cam image displaying cleanly? - Operate Doc Cam controls via panel buttons successful?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 3.2: Voice Reinforcement

				Description of issue(s)	Remedial actions required
Microphone - Microphones automatically unmute on removal from dock? - Suitable level of voice reinforcement evident?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Ceiling Loudspeakers - Suitable level of voice reinforcement evident? - Output is audibly checked as evident from each individual loudspeaker?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 3.3: Induction Loop

				Description of issue(s)	Remedial actions required
Induction Loop Driver - No warning indicators evident?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Induction Loop functional test - Using induction loop receiver confirm clean signal across audience area?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 3.4: Power Provision

				Description of issue(s)	Remedial actions required
Desktop Power Provision - Sockets confirmed as live?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 3.4: Lecture Capture

				Description of issue(s)	Remedial actions required
Lecturecast PTZ camera - Preset programmed with correct field of view? - Use technican remote to move camera and then check camera returns to desired preset aim upon system restart? (Diamond cameras) - If no remote possible use IP controls for camera (Sony and Panasonic cameras)	Pass ☐	Fail ☐	n/a ☐	1.	1.

Lecturecast audio - Check all wearable microphones (if applicable) provide suitable audio input to Echo unit? - Check all boundary microphones are providing provide suitable audio input to Echo unit? (Note, if signal detected by wearable microphone then boundary microphones should be gated closed)	Pass ☐	Fail ☐	n/a ☐	1.	1.
Lecturecast presentation feed - PC signal to Echo confirmed as working? - Laptop VGA signal to Echo confirmed as working? - Laptop HDMI signal to Echo confirmed as working? - Doc Cam signal to Echo confirmed as working?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Lecturecast test recording - Produce short test recording confirm presentation, camera and auido successfully captured?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Section 3.4: IWB functionality (if present)

				Description of issue(s)	Remedial actions required
IWB Software - Appropriate IWB software for room hardware installed on Resident PC? - IWB can be launched from non-admin account?	Pass ☐	Fail ☐	n/a ☐	1.	1.
IWB calibration - IR Curtain and Sensor/camera calibration verified?	Pass ☐	Fail ☐	n/a ☐	1.	1.

Finger Touch IWB - Finger touch IWB confirmed functional?	Pass ☐	Fail ☐	n/a ☐	1.	1.
Pen-based IWB - Only ncessary on legacy non-finger touch systems - Pen IWB confirmed functional?	Pass ☐	Fail ☐	n/a ☐	1.	1.

UCL

Problems or Faults

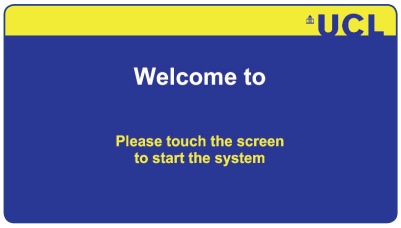
Every centrally-bookable teaching room has a telephone with a pre-programmed button to call for IT/ AV Service Desk:

- Service Desk will aim to resolve the issue via the call.
- If Service Desk are unable to resolve, the call will be transferred to a technician or a technician will be sent to attend.

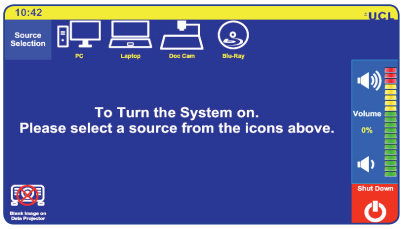
Lecture Theatre AV: Quick Start Guide

To turn on the AV equipment

- Touch the control panel on the teaching station to wake the system.



- Touch the panel again to access the controls.

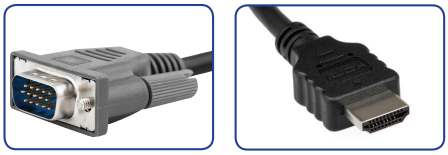


When you select an input source the projector will start to turn on.

To use the PC

- Select the PC icon on the control panel.
- If the PC image is not projected/shown on the monitor ensure the PC is turned on by checking for an illuminated LED on the PC and that the monitor is turned on (illuminated LED in the lower right corner of the monitor).
- Log onto the PC using your UCL credentials or the guest login facility.

To use your own laptop



above: VGA connection (left) and HDMI (right).

- Connect your laptop using either the VGA or HDMI lead.

If you use the VGA connection and require audio playback from your laptop please also ensure you connect the 3.5mm mini-jack to the headphone socket of your laptop. If you are using the HDMI connection no further audio connection should be required.

- Press the LAPTOP button on the touch-screen panel.
- Press the VGA or HDMI button according to which connection type you are using.

Many Apple laptops will require a Mini-DisplayPort adaptor. These are not provided on teaching stations but may be borrowed via Service Desk.

Mirroring the laptop display

If the laptop display does not show on the main screen follow these steps.

Windows laptops

- If using Windows 7 or above hold down the Windows key and press P on the keyboard to select the display options available.

continued over

2016 lecture theatre refurbishment instructions v2 – September 2016

above: example teaching station user instructions

- On earlier laptops look for the displays icon on one of the function keys e.g.

- Hold down the Fn button and tap the appropriate function key until the image shows on both the laptop and the projector.

Apple laptops

- Hold down the CMD key and press the F1 function key.
- If the laptop doesn't appear to recognise that the projector is connected try unplugging and replugging the display adaptor.

Audio from laptop

If you are using an HDMI connection on your laptop no further audio connection should be required.

Audio playback via Mini-DisplayPort to HDMI adaptors is not supported on some earlier Apple laptops. On later models you may need to review the output settings in the Sound Preferences panel.

To use the overhead camera

This room is equipped with a ceiling mounted document camera.

- Press the DOC CAM button on the control panel to activate the camera.

By default the camera projects a red dot to show the centre of the pick up area. You can zoom the pickup area on the control panel and/or toggle the Autofocus on/off. If using the whiteboard surface set into the worktop it is a good idea to toggle Autofocus off and use the manual focus controls.

Content displayed via the document camera will be captured in Lecturecast recordings.

Adjusting the worktop height

The teaching station is height adjustable so that you can comfortably write underneath the camera. The height controls are under the front edge of the worktop.

To use the video player to play optical discs

Touch the Blu-Ray button on the control panel. The player provided can play most types of disc including:

- UK Blu-Ray
- UK DVD
- CD audio discs

Standard playback control buttons will appear on the contol panel.

Using the microphones

Mircophones are provided for:

- Voice reinforcement
- Lecturecast
- Induction loop assistive listening system for the hearing impaired

Please ensure each presenter wears one for the benefit of your learners.

Remove the microphone from the charging dock and clip it onto your clothing. The microphone will work after a few seconds. A green flashing light indicates the microphone is working.

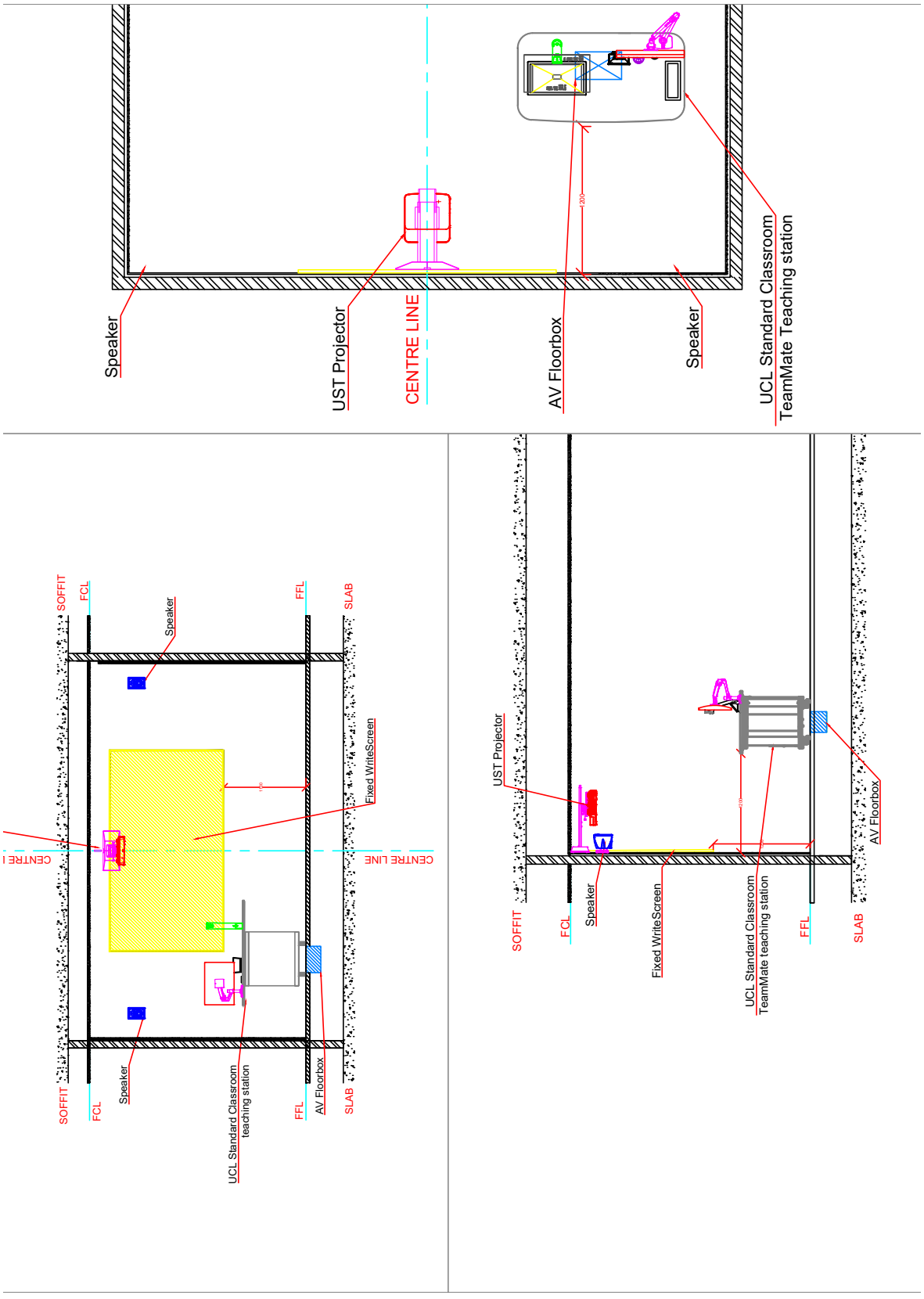
After use return the microphone to the charging dock.

At the end of the session

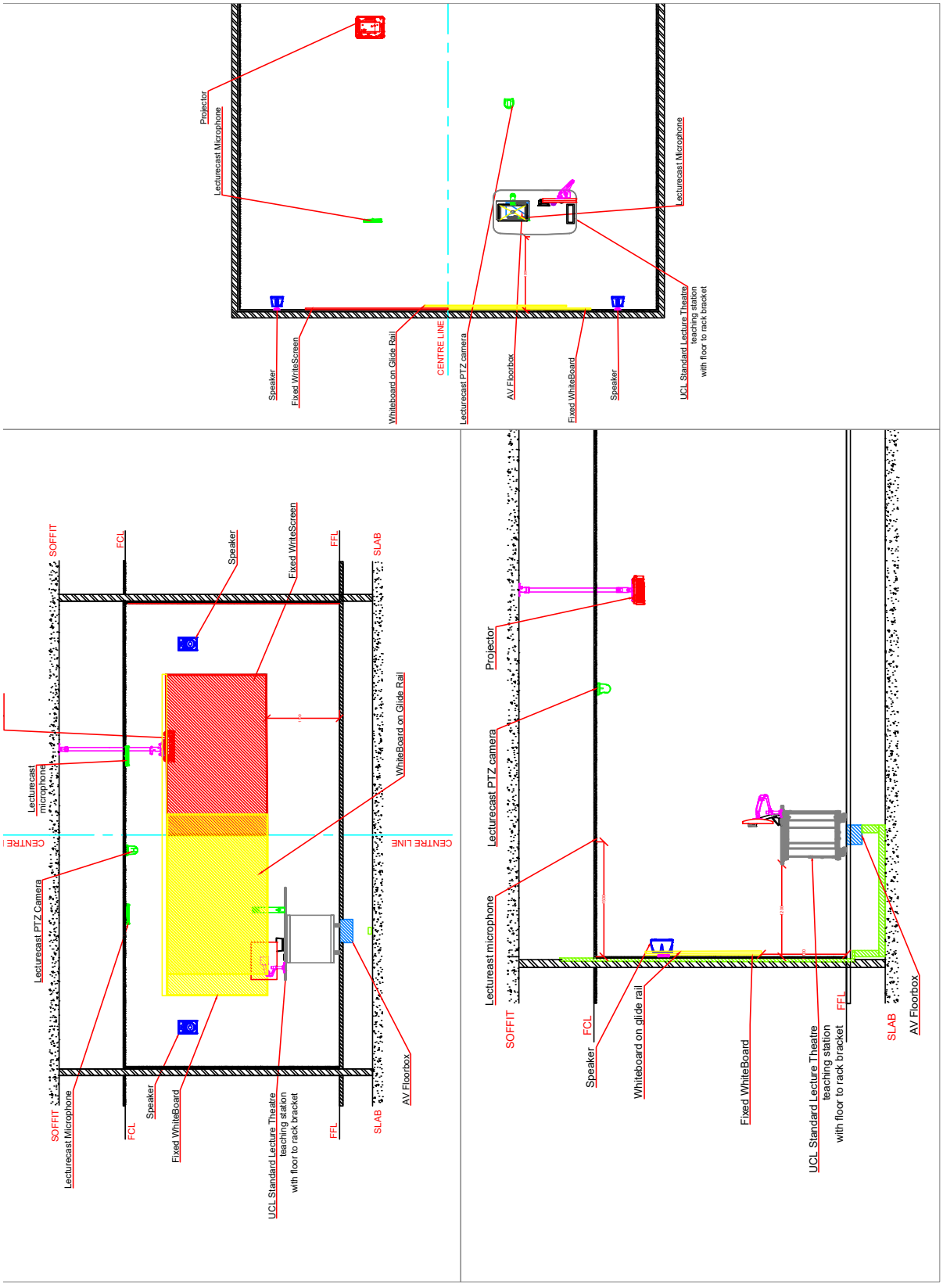
Please ensure you:

- Log out of the PC (if appropriate).
- Press the Shutdown button in the bottom right of the control panel.
- Press Yes to confirm the shutdown.

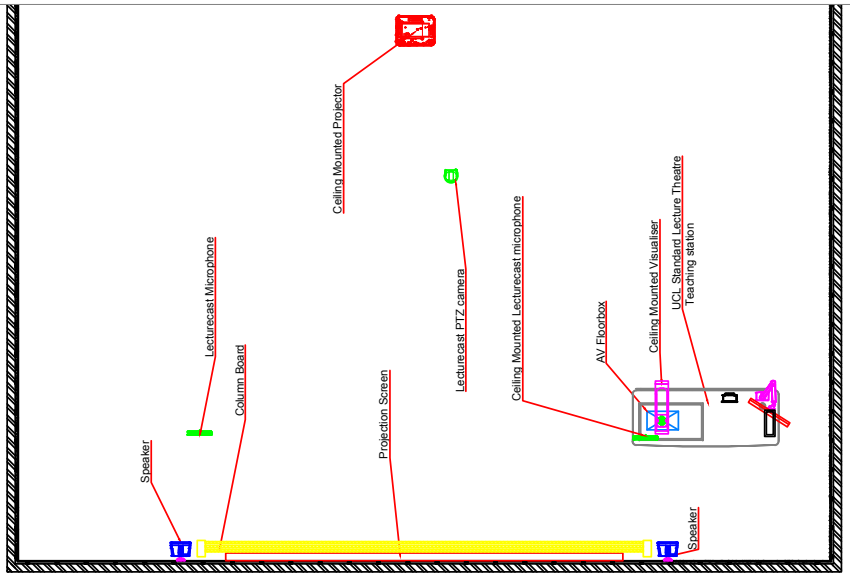
above: example teaching station user instructions (rear)

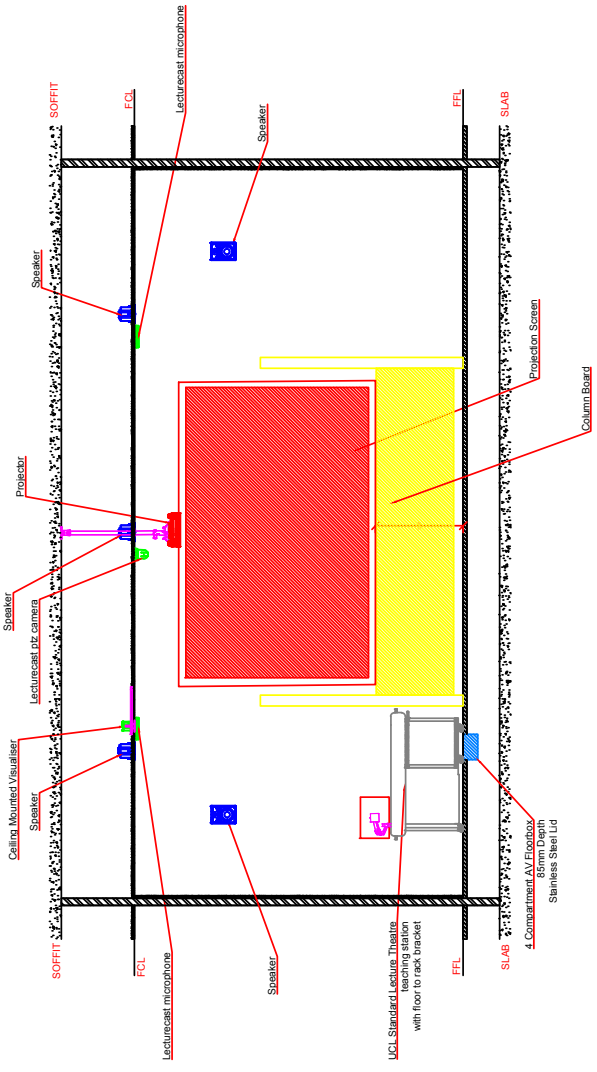

Speaker
UST Projector
CENTRE LINE
AV Floorbox
Speaker
UCL Standard Classroom
TeamMate Teaching station
SOFFIT
FCL
Speaker
FFL
SLAB
Fixed WriteScreen
CENTRE LINE
SOFFIT
FCL
Speaker
UCL Standard Classroom
teaching station
FFL
AV Floorbox
SLAB
UST Projector
AV Floorbox
SOFFIT
FCL
Speaker
Fixed WriteScreen
UCL Standard Classroom
TeamMate teaching station
FFL
SLAB

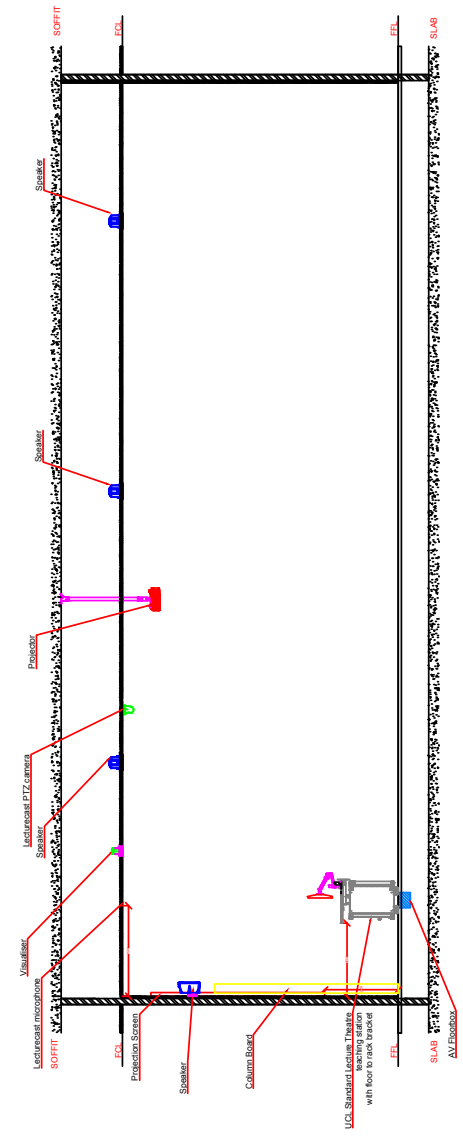
Appendix 4: UCL standardised medium classroom design



Appendix 5: UCL standardised lecture theatre design







Appendix 6: UCL classroom decoration specification

The below applies to UCL centrally bookable classrooms.

N.B. In general and subject to the appropriate approvals

Category	Specification	Comment
Carpet	To be to the standards set out by in the Milliken Nordic Stories and Light Trails range and be based on carpet tiles with the light lines tiles providing clarity of walkways to those with a visual impairment (stairways, aisles, exit lines through furniture). http://www.millikencarpet.com/en-gb/products/flip-books/quick-ship/Quick%20Ship.html#p=8	
Suspended ceiling tiles	Armstrong – Dune or Academy – for general teaching spaces	
Wall decoration	Dulux Trade diamond matt – Jasmine White or RAL 9010	
Woodwork decoration	Dulux Trade diamond satinwood or eggshell – Brilliant White	
Ceiling decoration	Dulux Trade vinyl matt – Brilliant White	
Lighting system	Consult UCL Estates for latest specification to suit use of room, light levels, feature lighting, environmental factors, etc. Also see Section 2 section for guidance on slecting luminaires.	

Other relevant UCL guidance

UCL Fire Safety Technical Notes & Mandatory Instructions
http://www.ucl.ac.uk/estates/maintenance/fire/documents/

Further information

Association of Educational Technology Managers (Australia) (2012)*"AETM Design Guidelines for Tertiary Teaching Spaces: 2nd Edition"*:
http://www.aetm.org/uploads/media/AETM_Audio_Visual_Design_Guidelines_2nd_Edition.PDF

Boys, Jos (2011) *"Towards Creative Learning Spaces: Re-thinking the architecture of post-compulsory education"*. Abingdon: Routledge.

Educause Learning Space Toolkit (2012) *"A Resource for Designing and Sustaining Technology-Rich Informal Learning Spaces"*:
http://learningspacetoolkit.org

Fisher, K. (2010) "Technology-enhanced active learning environments: an appraisal." (TEAL-OECD)
http://www.oecd.org/education/innovation-education/centreforeffectivelearningenvironmentscele/45565315.pdf

InfoComm (2014) *"AV/IT Infrastructure Guidelines for Higher Education"*:
http://www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/40836.htm

JISC (2006) *"Designing spaces for effective learning: A guide to 21st century learning space design"* plus further multimedia resources:
http://www.jisc.ac.uk/eli_learningspaces.html

JISC Infonet Flickr photostream showing many images of UK university learning spaces:
http://www.flickr.com/photos/jiscinfonet/sets/

Learning Space Rating System, Educause project that provides a set of measurable criteria to assess how well the design of classrooms support and enable active learning activities:
http://www.educause.edu/eli/initiatives/learning-space-rating-system

Oblinger D.G.(ed) (2006) Learning Spaces (e-book)
www.educause.edu/learningspaces

UCISA/AUDE/SCHOMS (2016) *"UK Higher Education Learning Space Toolkit"*
http://www.ucisa.ac.uk/learningspace

University of North Carolina at Greensboro "*Journal of Learning Spaces":*
http://libjournal.uncg.edu/index.php/jls/index