ARCHITECTURAL GUIDELINES FOR INSTRUCTIONAL TECHNOLOGY

Introduction
A classroom is measured by its effectiveness in facilitating the exchange of information. The following general guidelines have been developed as a tool for the design of new classrooms and for alterations to existing classrooms for the UC San Diego campus. These guidelines are intended to prompt a dialogue between architects and audiovisual (AV) consultants during early in the planning process to help determine the most important classroom design criteria. They are not intended to establish rigid standards for the design, construction, and renovation of classrooms, nor are they intended to replace specific program requirements.

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1. Classroom considerations

   a. Location of classroom
   Avoid costly retrofits for noise and vibration isolation by locating classrooms as far as possible from loud outside street and traffic noises, mechanical building noises such as those created by elevator shafts, and plumbing noises typical of bathrooms or kitchens.

   b. Size of classroom
   The classroom should provide additional support space for the layout of the instructor's materials, while minimizing viewing distance to chalkboard, projection screen, or video monitor for students.

   c. Dimensions of classroom
The shape and size of a classroom can affect the delivery of audiovisual information. The projection screen must have enough ceiling height to allow the necessary vertical size to provide good visibility from the back of the room. This is particularly important for PowerPoint and other text based presentations. In flat (non-tiered) classrooms the bottom of the projection screen must be four feet or more above floor level for comfortable viewing from the rear rows over the heads of the seated students in the front rows. By observing a simple ratio of minimum ceiling height to room depth, the architect can provide the adequate projection screen area required for comfortable viewing of text, graphics, and PowerPoint presentations for the entire classroom seating area.

When calculating the distance from the projection screen use the following:
- Minimum distance to front row = 2 x image height
- Maximum distance to back row = 6 x image height

d. Media systems infrastructure
Identifying the end users, understanding their requirements, and conveying that information to the architect is an essential part of the design process. It is imperative that media systems infrastructure is thoroughly addressed during design development. See section 2: Classroom media systems and infrastructure.

e. Acoustics and noise criteria
Speech intelligibility, critical for an effective presentation, is directly related to the acoustics of the room and the NC rating (background noise in the room). The best sound system cannot improve upon poor acoustics so it is essential to start with a relatively quiet room and good acoustics. UC San Diego has established a maximum NC of 25 A-weighted for presentation spaces on campus.

Another factor that contributes to the loss of speech intelligibility is reverberation, which is measured by reverberation time (RT). A long RT of several seconds in a room will cause syllables to be prolonged so that they overlap and degrade speech intelligibility. Furthermore, people tend to increase the volume of their voice in reverberant rooms to compensate for the increased noise level so that they will be heard over the reverberant noise. This further exacerbates poor speech intelligibility.

The surface finish of each wall, ceiling plane, and the floor contribute to the acoustics of the room. Surface area is important when considering the application of acoustical treatment; the more area you cover the more you can affect the sound. Careful consideration should be given to the absorption coefficient of all surfaces.

f. Chalkboards
Allow for space around chalkboards so they can be illuminated appropriately at the same time the projection screen is down and in use. The projection screen and chalkboard should be positioned so that one contiguous chalkboard section of at least 8 feet in length is available when the screen is down.
2. Classroom media systems and infrastructure

The key to elegant and functional integration of media equipment and architecture is effective
communication between the architect and the audiovisual designer. Audiovisual requirements may
conflict with the architect’s concept for the look and feel of the space. Engaging early in the
planning phase allows time to consider all aspects of media integration including: projection
screens and sightlines, cable pathways, mounting structure and integrated enclosures for flat panel
display, projector, loudspeakers, AV equipment power, and cooling requirements.

a. Audiovisual, cable television, telephone, and data
Contact Facilities Design & Construction and Academic Computing & Media Services for
additional information on communications cabling infrastructure. Refer to the UCSD
Telecommunications Design Guidelines (section 12 of this document) for additional
criteria.

b. Window shades
All classrooms requiring projection should have effective, easily operated closures over the
windows in walls and doors so the room can be completely darkened. Blackout drapes
should be used wherever possible. An automated system is recommended as it allows for
preprogrammed functions and standardized control of shades.

c. Lighting
Classroom lighting systems must support multiple conditions to provide the necessary
balance and control separate lighting zones are required. Classrooms require sufficient
lighting for student work areas as well as illumination of chalkboard and demonstration
benches. 50 foot-candles at the work surface is recommended. To maintain the “darkness
level” on the projection screen necessary for good image contrast, light spillage onto the
projection screen must be minimal. 10 foot-candles maximum at the projection screen
surface is recommended. For more information on image quality and lighting refer to
Media equipment – projectors (section 3.D of these guidelines).

d. AV Infrastructure
Structural backing:
Structural backing should be located on the front wall to adequately support the weight of
chalkboards and flat panel displays.

Floor boxes:
Flush-mounted floor boxes with notched covers allow a clean cable-exit to power laptops
and other portable AV sources, as well as lecterns and instructor workstations. Floor boxes
should have the following minimum attributes:
• 12 total gangs (6 per side)
• Configurable internal brackets to support data/telecom, power, and AV interconnect
requirements
  o 6 gangs for custom AV communications outlet
    ▪ 2 minimum 11/4” conduit
  o 2 gangs for floor mounted telecommunications outlet*
  o 3 gangs for power requirements
  o 1 gang spare
    ▪ 1 minimum 11/4” conduit
AV system junction boxes (J-boxes):
AV system J-boxes should be located at the AV controller, behind flat panel displays, and at AV media outlets. The AV controller location should be coordinated with lighting controls near the instructor.

Power and data:
Electrical quad and telecom/data outlets next to each wall-mounted media outlet, and inside designated sections of floor boxes, should be located to support activities and personal electronics of instructors and students. A recessed “clock” electrical outlet and data plate should be located behind the flat panel display. Refer to the UCSD Telecommunications Design Guidelines (section 12 of this document) for additional criteria.

e. Electrical requirements
Noisy power or improper grounding can affect the ability of instructional technology equipment to display clear images and noise free audio. Utilizing isolated ground for audiovisual equipment is suggested. Providing separate and dedicated circuits for audiovisual equipment is required.

f. Projection Booths
Larger classrooms, distance learning spaces, and film study rooms require a projection booth in the rear of the room. The projection booth isolates projector noise from the classroom and provides a secure location for media equipment. The booth allows the operator to control equipment and remain unnoticed.

   General booth design criteria
   A minimum practical size for a projection booth capable of housing media equipment and operators is 16 feet wide by 8 feet deep. The projection booth door should not open to the exterior of the building, nor should it be positioned in a way that allows sunlight to enter the booth or the classroom.

   Projection window
   Install a single projection window that provides good visibility for the operator and allows flexible placement of the projectors. The window should be high enough so projected images pass over the heads of members of the audience and wide enough to allow for projection on the perpendicular centerlines of each screen. The glass should be optical quality and without imperfections.

   Noise isolation
   Noise from inside the projection booth must be contained to the booth. Use dual pane glass with perimeter gasketing to increase isolation. Use angled glass to prevent a reflected image from being sent back into the projector lens. A seven degree outward tilt from the perpendicular plane of the projector is recommended.

   Ventilation and air conditioning
   Projection booths should be equipped with separate systems or zoned independently of the classroom. Audiovisual equipment can at times produce large amounts of heat. It is recommended that HVAC design should accommodate a heat load 1.5 times the maximum expected heat load of the audiovisual equipment.

*Refer to the UCSD Telecommunications Design Guidelines (section 12 of this document) for additional criteria.
3. **Media equipment**

Due to the highly technical nature of media equipment, performance parameters change quickly as do customer expectations. Solutions may vary depending on specific classroom conditions and should be considered on a case by case basis.

a. **Faculty workstation lectern**
The faculty workstation lectern provides ease of control for the instructor and security against theft. The lectern must provide space, power, and cooling for media equipment and connectivity to room audiovisual and campus network connections.

b. **Projection screens**
The projection screen requirements on campus vary classroom to classroom, depending on instructional needs and architectural elements, such as room size and ceiling height.

c. **Projectors**
Finding the right projector can be confusing and mistakes costly. There are hundreds of projectors currently on the market.

The perceived quality of the projected image is a combination of elements:

- Resolution: the ability of the projector to display fine detail
- Color depth: the ability of the projector to display a range of color
- Color accuracy: the ability of the projector to accurately display the original content
- Brightness: the amount of light the projector can put on the screen
- Black level: the ability of the projector to display to pure black; actually a function of the lighting in the classroom (see more on contrast below)
- Contrast: the ability of the projector to display a range of light intensity from full white to pure black.

Without good contrast it is difficult to perceive text and images seem gray. When an image is projected, we are looking at light reflected off the screen. White is determined by the light output of the projector and the reflectivity of the screen but black is only achieved through absence of light. It is impossible to achieve good contrast, even with the brightest projector if there is room light illuminating the projection screen.