Technical Design Guide for Southwestern Community College District Smart Classrooms



21st Century Classroom Task Group & Institutional Technology

Acknowledgments

The 21st Century Classroom Task Force at Southwestern, along with members of the campus community, dedicated time to create and publish this design guide. An annual update will be provided to evaluate and document changes in the technical environment.

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Task Force Working Group:

Other members of the campus community including faculty, staff and the student body have contributed their collective knowledge to the progressive design of our technology-rich learning spaces. To all of these individuals we express our deepest appreciation.

Institutional Technology has created a Classroom Design Team representing each of the areas where technology plays a critical role in the development and implementation of Instructional space. The members with their roles and responsibilities include:

Name	Position	Role
Paul Norris	Computer Operations Supervisor	Coordinator & implementation lead
Hector Reyes	Lead Instructional Lab Technician	AV Lectern and computer system
Dave Walwick	Audio Visual Repair Technician	Projection & room controls
Dan Borges	Chief Information Systems Officer	Comm plan & doc management
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<u>Appendix: K</u> AV Tech Design Guide Smart Classrooms

RFP No. 1617 -151 Professional Audio-Visual Design, Integration/Implementation Services

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1. Introduction

We present this design guide as the distillation of what Southwestern College has learned the past few years about the design, construction, renovation, and maintenance of instructional spaces. It compiles the knowledge and experience of those responsible for day to day campus operations as well as those who plan for the future. We consulted vendors and experts in the various components that make up teaching spaces. Research on the latest trends in teaching in higher education was reviewed as well as design guides from other colleges and universities. More important, it reflects our careful listening to the faculty and students who live and learn in the environments for which we are responsible. We expect this document to continue to be refined as we learn more, grow in experience, and receive more input from those who use the spaces.

The planning and writing of this design guide was carried out primarily by representatives from Southwestern College Academic Affairs and Institutional Technology. The goal of this document is to present a strategic framework to obtain the most effective design for Instructional space thus improving student outcome and success. As standards are defined for a more ubiquitous environment, expectation of equipment manufacturers for procurement will be called with brackets such as: [Epson], for example.

As the 21st Century team learned new ideas and concepts, the objectives changed slightly since the committee's inception. It's important to cover the foundational ideas that built the strategies that helped to deliver value to Southwestern College. In the <u>Memo dated</u> <u>9.12.14</u>, the summary of the committee's work was documented along with the Final Performance Specifications (specifically Collaboration, Ease of Use, and Compatibility and Reliability and Total Cost of Ownership, Scalability and Maintenance) and the Planning Schedule. In addition, the committee defined specific categories such as: Baseline (present day technology) and Smart Boards (wall-based technology). As additional concepts become evident, they will be documented.

Collectively referred to as

The 21st Century Classroom Planning Project team meets monthly to:

- > Set priorities on classroom renovations and features required for new rooms
- Plan and budget for improvements
- > Coordinate with customers, SWC services, vendors, contractors, and others
- > Project manage classroom renovations and new classroom construction
- > Design and conduct classroom user surveys
- > Update and expand classroom information databases
- Develop classroom user policies
- Perform ongoing facility assessments
- > Plan, develop, and conduct user training and user guides

A note on the Americans with Disabilities Act

Southwestern College adheres to the Americans with Disabilities Act (ADA) for its construction and renovation projects. The Classroom Design Team works closely with Facilities, Operations & Planning and the Office of Disability Support Services to recommend accessibility design and upgrades to all instruction spaces.

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2. Basic classroom layout

The conventional method of designing the room first then filling it- usually leads to an inefficient layout, poor sightlines and reduced seating capacity. Classrooms should be developed from the 'inside out'. There are many factors that contribute to a well-designed Audio-Visual (AV) room. Anticipation of future requirements was considered.

The following items were considered with designing new classrooms and details are available in the 'Southwestern Community College District Interior Space Design Guidelines', which was revised and approved on 21 October 2014':

- Determine the number and size of screens required based on the student seating capacity (tables, chairs, desks), type of room, and display needs.
- Determine the general location, size and orientation of screens, whiteboards, and seating space.
- Ensure the instructor area meets the minimum dimensions required.
- Draw viewing angles from each screen and ensure that all student seating falls within the viewing area.
- Determine the width and depth base on the proposed seating space guidelines
- Determine the location and size of aisles

A) Basic technology

Each room will be equipped with four active network drops in a 4-gang box (referred to as a quadplex) grouped together at the instructor AV lectern location and a quadplex of network drops at the projector location. One standard line for tele-communication is required at the front of each classroom as well.

Instructor AV Lectern: The network quadplex should be secured near the instructor lectern in a location that is easily accessible. Also a single Cat 6 cable should be run from the AV lectern for the Instructor station to the projector location to be connected to an HDMI Twisted Pair Extender at the ceiling location for the projector. A room control mechanism is required to monitor and control all inputs and outputs of the system. [Extron] In addition, a computer with monitor, network connection to student network, wired keyboard, and mouse should be housed in the AV lectern. This machine would be used by Instructor to control the technology of the classroom. In addition, the following are required with easy access for an Instructor at the AV Lectern.

- Wired keyboard & mouse
- Monitor
- Additional audio-video connection for a guest
- Spare A/C power for a guest or another device
- A room control monitor and controller
- Spare USB ports to connect other devices such as a Document Camera
- Room lighting controls
- Wireless keyboard and mouse
- Blu-ray Player

The cables, along with electrical power, should run through the AV lectern and become a cable 'whip' that is then connected to the floor box. The whip should be designed to provide mobility of the AV lectern to move a few feet in either direction and be oriented in a preferable manner to the classroom. The wall box for the room's telephone line should be located close to the AV Lectern.

Projection and screens: In general, a ceiling mounted projector on a pole is the district standard. The projector mounted on the pole must be capable of projecting 16:10 aspect ratio with a standard resolution of 1280 x 800. In some cases, a resolution of 1920 x 1200 may be required [Canon]. The screen must be large enough to project the entire image using the optical focal length of the projector.

Confidence monitor: A ceiling or wall mounted LCD or LED monitor will be mounted to project the same image from the Instructor AV lectern computer system. This additional output will assist Instructors with the presentation of their lecture. The approximate location of the confidence monitor would be somewhere near the back wall of the classroom and as close to the AV lectern as possible so the Instructor can easily see the image.

Wireless: Wireless coverage in College classroom buildings should be robust enough to allow all users in the room the option to use the Southwestern wireless network. Generally one Cisco Access Point will allow 50 connections [Cisco Airnet 3702-I].

The District Network Infrastructure Design Standards document written by the IT Network team is available from the Southwestern College Sharepoint website. This document has detail and the required specifications for fiber infrastructure to and within Southwestern buildings. All infrastructure specifications for buildings and building distribution should be obtained from the document mentioned above.

B) Lighting and Electrical

Zoning and controls

Proper lighting is an important, albeit complicated, element of any teaching space. Lighting needs are dependent on factors such as room size and shape, whiteboard size, AV configuration, ceiling height, and windows. A minimum of 4 power outlets per AV lectern is required use for computer, monitor, peripheral, and guest laptop.

The following are general guidelines for lighting specifications:

- Either hard switches or a Lutron dimming panel should be located near the entrance of the room and near the instructor's station. If the room is not equipped with lighting controls interface, another panel of switches or Lutron dimming panel should be located near the instructor's station.
- Lutron dimming and control systems are preferred due to ease of interface with audio visual control systems.
- Hard switches for dimmable lights should have sliders to control dimming

Lighting zones

As a rule, all classroom spaces will have lighting organized into a number of zones. These zones can be combined and switched to create a number of different lighting scenarios, there are two primary lighting zones in most classrooms:

Zone 1 – Main classroom lighting (student seating area) Zone 2 – Projection area

Note for Zone 2 – Projection area: While light bleed isn't the problem it once was, it is still important that light not shine directly on a screen during projection. Because of this, we recommend that lights which shine directly on the screen be switched separately. They can be turned off during presentations, but turned on when maximum whiteboarding are needs to be illuminated

Note that additional lighting zones may be required based on unique needs.

C) HVAC

Diffuser location

Pay specific attention to the location of the diffusers in the classroom layout. Do not locate diffusers near projection screen or whiteboard; this is to avoid conflicts with the mounting of the audio/visual equipment in the ceiling. Care should be taken to avoid drafts on projection screens. This can cause the screens to move in the breeze while in use.

D) Room security, windows, walls, and acoustics

All classroom doors should be outfitted with a functional lockset with a mortise lock. Doors should be located at the back of the classroom so that students entering and exiting the space will not disrupt instruction. Windows should be installed in every classroom. Window coverings can be manual if they are easily accessible and minimal in quantity. If windows are too high to reach and/or are too numerous, then the window treatments should be motorized and capable of being controlled by the AV touch panel. Motorized shades are recommended. Use of light diffusing shades on a roller is recommended.

Walls should extend to structure above ceiling to provide sound isolation and folding or moveable walls should be avoided. The front wall may reflect sound to the rear of the room.

3. Classroom Technology

AV systems in Southwestern classrooms should be designed for the delivery of most commonly used media -- whiteboards, projection screens, digital displays, DVDs, compact disks, document cameras, and computer- generated media. Classrooms must also support legacy systems such as portable equipment that can easily be set-up by AV technicians for occasional use. The following sections provide applicable guidance for each of these categories.

A) Instructor AV Lectern

Technology-rich classrooms should include an Instructor AV Lectern designed to accommodate audio-visual systems, presentation computer and other commonly used audio-visual components and control devices. The lectern should be designed for instructors who are standing or seated.

Most "off-the-shelf" lectern furniture does not meet our goals. The College has worked closely with AV vendors and custom millwork companies to develop custom designs that do meet these goals and seek to standardize workstation and user interface design for each classroom. This standardization simplifies ease of use and minimizes instructor training. Refinements to the College's custom- designed instructor workstations are made periodically.

Floor plans and cross sections that show the lectern must be included in design submissions. Floor plans and sections must show the location of the following:

- Instructor AV Lectern drawn to scale
- Other portable media projectors and carts (if proposed)
- Locations of wall or floor junction boxes for system wiring to serve the lectern

An Instructor AV lectern with both a standing and sitting location is illustrated below:



• Lecterns shall be oriented to allow instructors to maintain eye contact with students while using keyboards and allow students to see projected media.

- In rooms with one screen, an instructor workstation on the left side of the instructor area, marker boards in the center, and a screen mounted diagonally in the right corner.
- In large rooms with multiple screens, a lectern located on the left side of the instructor area, near the marker board, usually works well, but a more central location may be preferable in some rooms. Tables used for instructor notes or references may also be needed.

Lectern space accommodation

AV components shall not block views of screens and marker boards and should be ADA compliant.

Lectern instructor accommodation

- a) Provide accessible route to workstations for wheelchairs
- b) Computer wired keyboard, mouse, controls within easy reach of instructor
- c) Control panel for A/V system in easy reach of instructors
- d) Height of instructor's seat easily adjusted 17 to 30 inches above floor

Lectern Security

- a) Security of lectern components will be enhanced by using exterior door locks either electronic or keyed. The College will designate a lock style in order to standardize for locking/unlocking.
- b) Lockable user doors to secure AV equipment. Use of pocket doors is recommended to save space.
- c) Door access in lectern back for technician access to computer and audio- visual components for maintenance lectern key lock (or electronic locking code) to be different from user key lock.
- d) Security cables to secure computer, computer monitor, and document camera equipment to a solid support structure within the lectern.

Instructor AV lectern shall provide space for the following

- a) Instructor's references and handouts
- b) AV Touch Panel controls
- c) Computer monitor with articulating arm so Instructor can easily adjust it.
- d) Cable chase (including power/data/HDMI/ and stereo mini connection for laptops, computer device extensions such as USB.
- e) Audio-visual components installed in standard racks with user and non- user equipment grouped separately
- g) Space for computer and user AV equipment access

Floor Boxes and Wall Boxes

As a rule, the AV lectern cabling should run using a cable whip from a floor box. In some cases, wall boxes may be employed but they must be configured to not create a tripping hazard or disrupt the visual aesthetic of a space. Floor Boxes must be large enough to accommodate power, network and AV cabling to the AV lectern and still maintain adequate clearance when the lectern is positioned over top of the box. Cables must not rub against the bottom of the lectern or crimp.

B) AV control & management

The AV contractor will provide Southwestern a schematic of all interrelated AV components. Control systems for electronic components will have the capability of controlling the components identified above as well as projection screens, room lights, and shades operated by electric motors. Currently all control systems must:

- Be consistent with Southwestern standards [Extron]
- Be programmable and capable of being re-programmed by College technicians
- Interface properly with controls for AV equipment, screens, lights, and shades and other selected programmable devices
- Have a touch panel on the instructor workstation with easy-to-read, simple menu choices which mirror Southwestern College chosen standard design. Design samples will be supplied by IT (see sample design below)



- All source code and access passwords shall be provided to Southwestern at time of product delivery.
- The AV vendor will provide updates to existing code during the life of the equipment service warranty.

The features should include:

Monitoring - the current state of the room such as online state for system and display, activity logs, lamp life, audio mute, active source, active output (video), projector communication or error, schedule power off, and audio.

• Scheduling – System and Projector Shutdown. Cost savings for Southwestern with the use of scheduling technology by reducing the consumption.

• Other features - Remote updating of the code, remote diagnostics of the system, log files that allow problem tracking and usage information.

C) Computer

Commercial off the shelf (COTS) computers are routinely installed in a smart classroom. The computers run a current version of the Windows operating system with the standard Microsoft Office package. The management of large numbers of classroom computers has become a challenge in sustainability. In some unique cases, an AV Lectern may be run by an Apple computer.

Note: PCs generally come with a Blu-ray / DVD player and Apple equipment does not.

The convergence of digitized media and print material along with presentation software and connections to the Internet make computers an essential educational technology. Today's instructors and students now come to the classroom with advanced computer literacy skills and expectations relating to high performance.

Computer Standards

- > At least one computer with HDMI output installed in the classroom
- Ethernet connections for at least one classroom computer, one laptop, and possibly another connection for a student laptop in the front of the class
- Blue-ray drive
- Wired standard sized keyboard
- Wired optical scroll wheel mouse
- Computer audio (and other sources) distributed to room speakers
- Current version of Windows operating system
- Current version Microsoft Office

Blu-ray player

Each smart classroom needs to have source playback machines for CDs, DVDs, and Bluray media. External players are available to connect via USB.

Standards

- Ethernet network jack for control
- HDMI video output
- > IR ports for control through the standard room control system
- Consumer grade playback machines are acceptable
- > Playback decks should be able to fit in standard 1U rack space

D) Projection and amplified audio systems

To keep pace with current technology, the IT team should work directly with AV consultants and vendors to specify projectors that meet current criteria established by Southwestern College. Other considerations besides cost include projector performance, features, warranty, and lens options relative to room size.

Performance goals include:

- Low noise output
- Compatibility with classroom computers, laptops, & other AV components
- Uniformly bright, clear images with 1280 x 800 resolution and excellent color rendition
- Accessibility of lamp change housing NOTE: Projector mounts should not cover the lamp change housing area so that lamp changes can be made without removing the projector from the ceiling mount.
- Reliability including proven track record for good customer service and a competitive warranty
- Availability and cost of lamps and replacement parts
- Low-profile size to avoid blocking views of screens and whiteboards
- Availability of specialized projectors and/or lenses for unique classroom spaces
- Lamp free projector to save consumable bulb costs

Accurate sound reproduction for sound and moving image playback is important for the teaching spaces where playback is routinely done. For spaces without permanent installations a portable sound system may suffice.

While some data/video projectors have built-in speakers the sound reproduction has proven inadequate in permanent installs. Besides general classrooms consideration should be given to the specific amplification needs for the teaching of film studies and music with input from the respective faculties. In larger classrooms there may a requirement voice for amplification using a fixed lectern microphone and/or a wireless microphone.

Audio Standards

- Playback sound amplification should be present when a data/video projector is designed into the room
- There should be at least one each midrange left and right speakers
- Speakers should be mounted in the ceiling
- Film Studies and Music teaching faculty should be consulted about their specific needs.

E) Screens

The video quality objective for projection screens includes having a 16:10 aspect ratio with 1280 x 800 resolution. Screens should be designated for front projection in all learning rooms except for very large rooms. Screens shall be located and sized so all seats can easily see the entire projected image without discomfort or image distortion.

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Screen Size

- Minimum Height: 20% of distance to seat farthest away from screen
- Minimum Width: Determined by aspect ratio of projected images, as follows: *Current Technology:* 16:10 Aspect Ratio (Screen width to screen height) Example: 36 feet to screen, image 7.2 feet high, 9.6 feet wide Specify screen with nominal dimensions 7.5 ft high, 10 feet wide

Screen Location and Orientation

Motorized screens are preferred and they should be oriented towards the "center of gravity" of the seating area so students in all seats can easily see projected images and the whiteboards. In classrooms with only one screen, locate screen on right side of instructor area Minimum distance between screen and closest seat:

- a) Same as screen width: Rooms with 10-48 seats
- b) 1.5 times screen width: Larger rooms

Viewing Angles:

Provide an unobstructed view of the entire image on all screens from all seats within the viewing angles (cones of vision) described below:

Max 45-degree horizontal angle from the perpendicular to the center of screens



Max 35-degree vertical angle from the perpendicular to the top of each screen



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- Manual screens will be considered only in rooms designed primarily for interactive discussion and the project budget precludes the use of ceiling- mounted data projectors and other audiovisual components that are installed permanently.
- Manual screens should be wall-mounted above the suspended ceiling whenever possible. Screens mounted below the ceiling with exposed brackets are not desirable.

Rationale for using electric screens: Screens operated by electric motors represent less than 10% of the cost of an electronic audio-visual system. Installing them after rooms are built can be very costly if ductwork or lights must be moved and new wiring circuits added. Most manual screens are not very flat, distort projected images, are hard to raise and lower, and can be easily damaged. Students in rear rows cannot see the bottom half of projected images if manual screens are mounted just above the whiteboard.

Manual screens should therefore be considered only as a last resort in rooms where projected images are only needed infrequently.

Dual Screens

Certain teaching styles lend themselves to the use of two projected images at once. For example, an instructor may wish to show a streaming video presentation on one screen and create a spreadsheet cataloguing various aspects of the performance on another.

F) Document Camera

The cameras provide all of the image projection of traditional overhead projectors plus the ability to project images that are three-dimensional, in color or black and white, in the original visual format e.g., books, magazines, clothing samples, etc. Some document cameras have the ability to save images that can be replayed. The image projected is usually much brighter and clearer and larger than can be obtained from overhead projectors.

Standards

- A camera fixed to a base that allows it to fold away in the lectern for security
- Progressive scan camera
- Digital SXGA, XGA or SVGA signal on RGBHV and HDMI outputs
- Video out
- Automatic and manual zoom
- Brightness controls
- White working surface that dampens reflection and allows for transparency use

4. Other current considerations

A) Centralized room management & control

Use of a centralized room AV equipment monitoring is recommended. The features of the a potential systems include:

- Monitoring the current state of the room such as online state for system and display, activity logs, lamp life, audio mute, active source, active output (video), projector communication or error, schedule power off, and audio.
- Facilitate remote access to a live image of the touch panel in the lectern. With the remote access support staff is able to offer remote assistance, reducing the time to get to the room.

B) Mobile AV units

Classrooms may need additional AV equipment added ad hoc (e.g., 16mm film projector where there is not a permanent installation.) Additional AV equipment may be placed upon a wheeled, sturdy cart designed specifically for AV use. This allows for equipment to be stored in locations around the campus for proximity and prompt delivery by Institutional Technology when requested properly by Instruction.

Standards

- Carts should be designed for AV use specifically two heights are preferred: 30 inches and 42 inches with a two or three shelf design
- High impact plastic is preferable to metal, pneumatic wheels with brakes will allow better and safer transport over uneven surfaces and will avoid disruption of classroom instruction by squeaking wheels two or three-outlet power strip with a 15 foot power cord is preferred

C) Spare AV equipment

Each designated area should have at least one main AV storage closet with access provided for Institutional Technology to house a number of AV rolling carts, spare data projectors6mm motion picture projectors, sound amplifiers, microphones, VCR and DVD players, projector lamps, cables, and other equipment and supplies. The close proximity of the spares and backup equipment is vital to the quality of service so that the demands of a teaching space can be met with timeliness and a minimum of disruption of the teaching activity.

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5. Emerging technologies

A) Collaborative classrooms

Utilize application software to foster collaboration and communication between faculty and then with faculty and students. Using Cloud storage for file sharing and manipulation would invite interaction and collaboration between faculty and students in some cases and also would facilitate student work group activity. There are also other features and functions that would contribute in a positive way.

[Google Classroom]

One suite of applications is Google for Education. There are many other applications including calendars, and sites that could contribute to a unique and valuable shared electronic environment that could promote student success.

B) Student interaction using wireless projection

Utilize technology to provide faculty with tools and techniques to allow student interaction with projection systems to promote and foster group collaboration. Weather the choice is to utilize software solutions or a combination of software and hardware, the goal to allow students to share their work with the class over a projector would be the goal.

[NetSupport School, Vision, WePresent]

There a few applications available on the market

C) Instructor interactive whiteboard

Utilize hardware to provide faculty with interactive tools to annotate and save documents from a projected image. Interactive Smartboard allow and instructor to annotate a projected image during class. The new image could be saved electronically for future use.

[Smartboard]

Southwestern has a few Smartboards already installed on campus. The units do not replace the standard Instructor AV Lectern system.

D) Instructor wireless interaction with video control

Utilize hardware and / or software to provide faculty remote capability and move away from the Instructor AV Lectern while still controlling images from different video sources.

[Remote PC control]

There a several Android <u>and iOS applications</u> available to allow an Instructor to interface and control the Instructor AV Lectern during class to change or advance a presentation or to change a video source for the benefit of the class.

E) Hybrid classrooms using video connectivity

Utilize hardware and / or software to provide faculty capability to deliver content to both onsite and remote students.

[Distance Ed + Onsite]