

Planning the **Smart**Classroom



"A Practical Primer for Designing Interactive Video Learning Environments"

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SmartVideoconferencing™

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INTRODUCTION

Although much has been written about the design of effective classrooms for distance learning, it has too often been fragmented, overly technical or somewhat narrow in terms of practical applications in the “real world.” Most of the available documentation on the subject has been developed by engineers or technical designers who provide highly detailed information that is technically correct, but not necessarily reflective of the environments, budgetary limitations and practical challenges faced by today’s distance-education planners and decision makers.

PURPOSE: The purpose of this document is to provide a more cohesive and practical view, with generic, proven guidelines to assist a wide range of users — both novice and seasoned — in effectively implementing video-based teaching and learning environments that work. The information here is based on what has been learned over many years in a variety of applications and is intended to be both comprehensive and utilitarian. It should be stressed, however, that these are guidelines only — not steadfast requirements — and, as such, are realistic targets for facilities planners.

SCOPE: Current operating environments for distance learning range from small, one-on-one computer-based scenarios to large and elaborate multimedia centers accommodating 300 people or more. Rather than attempting to address such a broad spectrum of room sizes, applications and structural diversity, this guide will focus primarily on a “median” level model that best describes the average classroom in a typical K-12 school, community college, university or training center, seating no more than 25 to 30 students per room. The good news is that many of the principles and guidelines presented are also valid across the board and can be applied to the broader range of models.

Although the focus here is to design a room that will best support video-based applications, this does not mean it will be limited exclusively to that technology, or even to distance-learning applications in general. Instead, the intent is to guide development of an environment that is multipurpose and flexible enough to support both technology-based learning and traditional classroom applications, once again reflecting more accurately the current realities of today’s educational institutions, with their growing demands on limited space.

As with any generic guide, specific requirements will vary depending on facilities, network, equipment and instructional objectives. Readers are encouraged to contact their VTEL reseller and/or sales representative or a qualified distance-learning consultant for more in-depth information and detail in these areas.

GUIDING PRINCIPLE: Finally, the reader is reminded that any technical design or equipment strategy is only as good as it is relevant to the instructional goals, needs and pedagogies of the end user. Therefore, the recommendations set forth here must be tempered with common-sense teaching principles, ensuring that technology decisions should always be driven by people and applications, rather than by technology.

INSTRUCTIONAL OBJECTIVES

The effectiveness of any educational environment is ultimately measured by success in learning. The wise facility planner or system designer will base technology decisions on requirements defined within the instructional contexts of his or her institution, faculty, students and curricula. It is imperative that the planning and design process be inclusive, to assure that the technology and tools developed are compatible with educational concerns including:

- Instructional needs and objectives
- Teaching methodologies and styles
- Expected classroom dynamics
- Levels and types of student interaction
- Projected class sizes
- Content and curriculum

Classrooms and facilities designed in the absence of these considerations or without input from faculty, staff and students, will invariably fall short of expectations, no matter how technically correct they may be. Even in the smallest of institutions, the formation of a steering committee or planning team to oversee curriculum and technical design efforts is strongly recommended. Inclusion of faculty, curriculum developers, technical staff, consultants, vendors, administrators, facilities personnel and end users will avoid disappointments or finger-pointing down the road. From the beginning, the needs of the team should drive technology decisions.

PRINCIPLES OF GOOD AUDIO

Despite the heavy emphasis on video in the typical distance-learning environment, practitioners have learned a painful lesson over the past 20 years: GOOD AUDIO WILL GET YOU THROUGH TIMES OF BAD VIDEO — BUT THE REVERSE IS ABSOLUTELY NOT TRUE. Time and time again, through experience and user surveys, the message has been clear: the number-one complaint of users is about problems with audio. Fortunately, most of these problems can be solved with basic common sense and minimal planning.

MICROPHONES: Selection and placement of microphones is critical, and yet the common mistake is to cut corners in this area. Most major problems occur due to two factors:

PROBLEM #1: NOISE

Too many “open” (on) microphones in the system causes an accumulation of “noise” in the system that becomes more distracting as the number of mics, students and connected classrooms increases. This “ambient,” or background, noise can limit teaching effectiveness, is irritating to participants and can cause a variety of technical problems in multipoint conferences.

RECOMMENDATION:

Select microphones that provide multiple settings (switchable) for operation in either or all of the following modes:

- Push-to-talk: mic is turned on only when button or pad is depressed
- Touch-on/touch-off: mic is turned on or off when button or pad is depressed
- Constant-on: mic is on at all times when connected

These settings allow users the flexibility to control audio environments based on their specific configurations. Using either of the first two settings also ensures that microphones are only on when they need to be.

PROBLEM #2: PROXIMITY

Too few microphones for the number of students means that some students are heard, while others are not. It also usually results in widely varying levels of volume and can add to the ambient noise levels of the system.

RECOMMENDATION:

Use the two-students-per-one-microphone ratio as a general rule of thumb, to ensure minimal distance between student and mic (recommended distance between student and microphone is 18" to 30"). THIS IS NOT an area to scrimp and save a few dollars, as it will cost much more down the road in technical problems, inferior audio quality, low reliability and user dissatisfaction.

PRINCIPLES OF GOOD AUDIO

CEILING MICROPHONES: Although appealing in terms of aesthetics and cabling simplicity, the use of microphones mounted in ceilings as the primary source of audio in a classroom often creates more problems than it solves. This is especially true in multiple-site scenarios, where cumulative ambient noise from each site is exacerbated by the high levels of volume required for ceiling microphones to pick up widely dispersed students in the room. With today's VTEL® technology and its advanced "Automatic Gain Control" (AGC) built into all systems, this problem is minimized, but the use of multiple microphones on student desktops is still recommended — even in conjunction with overhead mic support.

BACKUP AUDIO SYSTEM: No matter how good the system, problems will inevitably occur. When they do, the successful distance-learning practitioner has a good backup plan. One such contingency is made possible via VTEL's "Audio Add-On" capability, which allows users access to audioconferencing via telephone. This audio-only option is an excellent tool for teachers and trainers who are experiencing conference difficulties; it provides the ability to continue the class or training session with a good degree of effectiveness and is already integrated into the VTEL system.

ROOM SELECTION AND LOCATION

It is assumed that most institutions do NOT have the luxury to “build from the ground up” and must convert existing facilities for interactive videoconferencing. In either case, several criteria should be addressed when properly selecting and locating the appropriate room(s).

SIZE: This document will focus on interactive video-learning applications in rooms for no more than 25 to 30 people. A more common range of students in the typical multisite teaching scenario is 12 to 18 students per site. Exceeding these numbers is feasible, but it challenges the effectiveness of spontaneous interaction between student and instructor — which is one of the positive differentiators for this technology. As with any scenario involving “remote” sites, proper classroom management is always essential.

PROXIMITY AND ACCESS: The facility selected should satisfy several basic needs in these areas. These include distances to network “points of access”, i.e., the telecommunications “hub”, or connections to the outside world. Minimizing these distances can reduce costs and enhance reliability. Similarly, there should be nearby access to sufficient electrical power. Also important is human access, which often entails a wide range of users requiring flexible hours, including evenings and weekends. As such, a location with easily accessible outside entry and exit points, as well as ample parking, is suggested. It is important to remember that no matter how good the facility is technically, it may be wasted or underutilized if it is not easily accessible to users.

NOISE: The importance of locating the facility in a noise-free area cannot be overstated. It should be as far away as possible from machinery, vehicle thru-ways, elevator shafts, restrooms, major plumbing or duct work, mechanical or electrical closets, kitchens, cafeterias and maintenance facilities. It also should be sufficiently far away from entry and exit points that are sources of distraction. Where possible, rooms should not be located on exterior walls. More on this subject is discussed under acoustical considerations.

ENVIRONMENTAL CONSIDERATIONS

The following is a condensed “checklist” for facility planners and administrators of the various environmental parameters that should be addressed during design and installation. Once again, this information is generic, and the enlisted support of a VTEL representative or qualified distance-learning consultant will be invaluable when pursuing higher levels of detail and expertise in these areas.

ELECTRICAL: Power requirements fall into three basic categories:

- Network
- Primary room system
- Peripheral equipment

Since these are variable, some basic rules of thumb include providing at least one dedicated 15 A, 120 V, 60 Hz circuit, supplied by at least one standard duplex outlet, PER EQUIPMENT SYSTEM, located no more than three feet from the equipment being powered. Additional monitors, displays, electronic boards, computers and other peripheral equipment should have similar power sources.

It is also recommended that some form of “Power Conditioning” be installed where available, especially in areas where voltage and current levels are susceptible to variances. Although this does add more expense to the overall system, it will be critical to reliability and long life of the equipment — especially in digital environments.

Care should also be taken to adequately separate power cables from other cables not in the same conduit, such as those carrying video, audio and data, to avoid electromagnetic interference and noise that can adversely affect the quality of these media.

ACOUSTICAL: Per the principles of good audio discussed earlier, acoustic considerations are among the most important for facility planners. Considerations include absorption and reflectivity, ambient noise levels, reverberation effects, wall coverings, floors, windows, ceiling height and room size and geometry. Without spending a fortune on expensive acoustical conditioning, some general rules of thumb are:

- Select a noise-free location
- Use well-insulated walls
- Avoid highly reflective surfaces such as glass, cinder blocks and bare wood paneling
- Cover floors with carpet and windows with sound-absorbent materials
- Install dropped ceilings, acoustical tiles and panels where appropriate

ENVIRONMENTAL CONSIDERATIONS

LIGHTING: The good news is that rapid improvements in camera technology over the past 20 years have made it much easier for the distance-learning planner to provide adequate lighting for users. Similarly, advancements in lighting have yielded brighter and better fixtures that operate at significantly lower temperatures, and with less noise, than those of only a few years ago. However, despite these improvements, some basic guidelines are still recommended, such as:

- Use four-tube rather than two-tube fluorescent fixtures
- Make sure the instructor is lit more brightly than the surrounding area by factor of 2 to 1
- Try to use some form of frontal lighting on instructor; avoid overhead lighting only
- Use directional louvered fixtures (available new or as retrofits)
- Use “low-noise” ballast fixtures
- Position fixtures “crosswise” in the room to minimize glare on cameras and monitors
- Avoid low-intensity projection systems and other displays requiring low room-light levels
- Provide adequate lighting for student work areas
- Avoid windows and outside lighting, and don't rely on blinds as coverings
- Avoid “noisy” room colors such as red, white and yellow. Also avoid dark colors. The ideal colors are medium shades of blue, green or light gray.
- Do not use patterned wallpaper

CABLING: When running cabling and conduit, use the “more, not less” rule. This means go ahead and install excess conduit and cabling all at one time (regardless of whether it will be immediately required) to facilitate future growth and flexibility. This will avoid costly trenching and building penetrations later, when expanded services are required. Most interior cabling is run above ceilings and must reside in either approved conduit or be “plenum rated” for use as stand-alone runs. Older facilities with cinder-block walls and no ceiling space for cabling present significant challenges and added expense. **IN ALL CASES**, avoid running cabling along floors except where absolutely necessary. If you must run cabling along floors, do so only when it is housed safely in interior panduit.

Types of cable and wiring differ depending on the application (video, audio, data) and traffic level (data rate, frequency, operating speed) of the media being supported. For high data traffic, for instance, Category 5 Twisted Pair wire is common. Coaxial cable, fiber and other forms of copper wire are suitable for most video and audio needs. Distances also play a key role in determining size and type of wiring. In most cases, a centrally located hub, or wiring closet, is selected to provide close access to and from connected rooms. Once again, prudent selection of the media to be used should involve careful weighing of current needs versus future demands.

ENVIRONMENTAL CONSIDERATIONS

Point-of-access outlets, or “drops”, should be numerous and easy to access in every room. These include telephone and telecommunications jacks, data connector plates, coaxial cable outlets and other wall-mounted connectors for cameras, response devices and other peripherals. The “more, not less” rule applies here as well, since connectivity requirements for rooms change over time based on user needs and applications.

WIRELESS: An unprecedented number of wireless solutions are available to users today, many of which provide both quality and cost-effective alternatives to conventional cabling approaches. These incorporate RF (Radio Frequency) and IR (Infra-Red) technologies for transmission media in the place of hard wiring. VTEL, its partners and its qualified consultants are available to advise planners in this area and give direction for designs that will offer enhanced applications for future VTEL products.

HEATING/VENTILATION/AIR CONDITIONING: These factors are critical to both human and technical aspects of the learning environment. Room designs should assure comfort for teachers and learners and provide a “healthy” environment for equipment and systems. As with previous priorities, proper focus, planning and investment in these areas will be more than justified in the long run, especially in terms of:

- Extended equipment life cycles
- Reduced maintenance
- Fewer repairs
- Higher facilities usage and user satisfaction

Because most distance-learning environments have been retrofitted from other uses in older buildings, HVAC can be especially challenging and often expensive to address adequately. Nevertheless, some minimal requirements must be met.

ENVIRONMENTAL CONSIDERATIONS

Heat generation is the primary concern. As a result, the recommended operating ranges for these environments whenever equipment is on or the room is in use are between 65 and 80 degrees F, with relative humidity between 30 and 60 percent. Placement of equipment, therefore, in cramped or poorly ventilated areas is strongly discouraged. Primary heat-generating considerations are:

- Type and number of equipment systems and peripherals in one location
- Average number of human participants in one location
- External weather conditions — both extreme heat and cold
- Type, quantity and size of lighting fixtures
- Facility use patterns—daily, nightly, weekend and seasonal

General rules of thumb include:

- Return air grilles placed close to heat-generating equipment
- Air supply diffusers located strategically to avoid interference with microphones
- Velocity of air should not exceed 500 cubic feet per minute
- Avoid main-feed ductwork above ceilings
- Maintain consistent environmental conditions while equipment is powered on

ENVIRONMENTAL CONSIDERATIONS

NETWORK CONNECTIVITY: As important and complex as considerations of hardware, software and interior design are those surrounding connectivity to the outside world. At a time when network options flourish, new services continue to evolve. In the maze of standards, protocols and formats that confront network planners, the key word is “flexibility.” Providing flexibility requires careful assessment of connectivity needs, evaluation of existing resources, determination of available network services and a good deal of expertise in integrating the various pieces together efficiently and cost-effectively.

SEEK ADVICE: In order to best address these complexities and implement a strategy that ensures future growth and maximum life span, facilities planners can enlist advice and support from a variety of sources. Local service providers, long-distance carriers, VTEL and other equipment vendors, as well as qualified consultants should be contacted. In many cases, this support is available at no charge as part of standard “sales support” activities, and the information necessary to make wise planning decisions can often be gathered without significant expenditure of resources or commitment to future purchases. Creating a strategy for future growth requires the utmost in careful planning and vision for the future, especially in the rapidly changing world of telecommunications and global access. Otherwise, planners risk investing in technologies that may be prematurely obsolete or incompatible with long-term goals.

THE “NETWORK MENU”: Today’s distance-learning environment should provide a maximum number of network service options to users, while leveraging existing telecommunications resources and infrastructure to their fullest extents. Duplication and/or redundancy of networks should be avoided, and seamless solutions for integration of varying topologies should be sought instead. “Gateway” solutions for interconnecting differing networks and platforms should be established. And connectivity options should include access to:

- Standard telephone lines (Voice, fax, audioconference)
- T1, ISDN, public switched services, ATM, fiber (interactive video)
- Local Area Network (LAN) services on campus (intranet)
- Wide Area Network (WAN) services between sites
- Online networks (Internet, World Wide Web)
- Internal cable distribution (CATV coaxial network)
- Satellite, ITFS and/or other RF signals and distribution

It is clear that these areas require considerable expertise in telecommunications and data communications technologies. Specific recommendations for interface equipment, connections, cables, line conditioning, distribution amplifiers, modulation, receiving and transmission equipment for various types of connections are best determined by your local carrier, network provider, VTEL representative or qualified consultant.

ENVIRONMENTAL CONSIDERATIONS

EXISTING RESOURCES: In the typical education or training institution, with limited infrastructure, resources and budgets, it is imperative that facilities planners leverage the resources they have to the utmost. Designers should seek practical and cost-effective ways to integrate network strategies to provide end users with the greatest number of access options. For instance, the rapid proliferation of broadcast and cable distribution of video-based programming into classrooms over the past decade has resulted in the installation of significant internal infrastructures on many campuses — mostly in the form of classroom cabling, monitors and VCRs. This infrastructure represents a valuable internal resource that should be utilized, even in conjunction with the newer technologies. Similarly, explosive growth of the Internet and data services in general has created local and wide area networks (LANs and WANs), along with other computer-based services that can be easily integrated into the fully interactive video environment. These, too, should be fully utilized.

VTEL's PC-based products, direct LAN interface and flexible integration capabilities are ideally suited to a wide range of applications. Wise planners will pursue solutions that not only implement newer interactive video technologies, but also utilize existing video, audio and data distribution capabilities of their respective campuses. This commitment to not “reinvent the wheel” through the practical integration of existing technologies is responsible and cost-effective — and viewed favorably by grant and funding entities.

Often such integration involves “gateway” approaches to interconnecting networks and equipment of varying types. Although sometimes technically challenging, these approaches properly handled can provide solutions that are both cost-effective and acceptable in both function and performance. Once again, the driving justifications for combining or connecting differing network topologies should be user needs and application benefits.

ROOM DESIGN AND CONFIGURATION

There are as many variations in room designs, configurations, layouts and seating arrangements as there are differences among schools, classrooms, teachers and learning styles. As might be expected, some work better than others. But there are basic principles and guidelines which are common to those that do. As stated earlier, the intent here is to focus on a median-level facility, with a maximum seating of 25 to 30 students.

SEATING: Though student seating capacity is ultimately based on facilities and individual instructional requirements, it should allow for a minimal space of 12 to 20 square feet per student. The following chart illustrates some basic student seating capacities (PLEASE NOTE that this chart refers to seating area only, NOT total room size):

STUDENT SEATING MATRIX

(Recommended Capacity Considerations)

Space (Seating Area)	12 sq ft/student (Students)	20 sq ft/student (Students)
20'x20'	33	20
20'x40'	67	40
30'x30'	75	45
30'x40'	100	60
30'x50'	125	75
40'x40'	133	80
40'x50'	167	100
50'x50'	208	125

In cases where this allowance is not possible, preference should be given to leg room, which should not be compromised. Lateral, shoulder-to-shoulder distance between students is somewhat less critical. The seating matrix also does not take into account spacing required for aisles, additional monitor placement, cameras, whiteboards, instructor workstations or between student work surfaces.

CONFIGURATION: For the median-range room size, several layouts can be effective. A graphic representation of one recommended configuration that is especially well suited to videoconference-based learning is found on page 14. Although this is a good example of a configuration that works, it is by no means the only one. Facilities planners have a great deal of flexibility in configuring their respective learning environments, provided they pay close attention to some essential criteria. Whatever the final layout, the parameters used should support ease of use, student and instructor comfort and effective learning.

ROOM DESIGN AND CONFIGURATION

CRITICAL CONSIDERATIONS: Be sure to take the following factors into account for a properly configured facility:

- Visibility (content, instructor, materials, placement/size of monitors/displays)
- Lateral viewing angles of students (pan angles not to exceed 40 degrees off-axis)
- Vertical viewing angles of students (tilt angles not to exceed 15 degrees off-axis)
- Line of sight (camera placement and angles)
- Fixed vs. multipurpose systems (dedicated vs. mobile flexible)
- Placement of interactive and peripheral equipment

STUDENT PLACEMENT: An ideal configuration supports two students sitting side by side at a single workstation (desktop or tabletop), with a single desktop microphone between them. These student duos can be angled slightly to provide a more direct view of the instructor, teaching aids such as the SMARTBoard® interactive whiteboard and centrally located camera and monitors at the front of the room and to maximize direct eye contact with other sites.

MONITOR PLACEMENT: For classes of 12 to 18 students, a single set of dual 27" to 32" monitors placed strategically at the front of the room will usually suffice for video and large-font graphics. For larger classes, additional "slave" monitors are recommended to support students seated in the rear of the classroom. These can be wall-mounted, ceiling-mounted or placed atop mobile audiovisual carts as needed.

CAMERA PLACEMENT: In a fully interactive video environment, placement of cameras is especially critical due to "eye contact" requirements. Therefore, cameras should always be placed slightly above, below or beside primary viewing monitors. This placement ensures that participants are looking into the camera at all times, providing face-to-face contact between sites. Placement of instructor cameras should follow these same criteria (usually with monitors at the rear of the room), even in situations where there are students physically located at the instructor's originating site.

DEDICATED VS. MULTIPURPOSE: The debate continues to rage regarding pros and cons of these two approaches. Fortunately, they are not necessarily mutually exclusive. The primary advantages of fixed/dedicated facilities are reliability, dependability, ease of operation and safety. The multipurpose facility, on the other hand, provides flexibility and in some cases mobility, but often poses technical and logistical problems in terms of setup, troubleshooting and system problems. The ideal configuration accommodates both scenarios by placing equipment unobtrusively enough in a set location to support technology-based learning AND traditional classroom teaching.

INTERACTIVE ACCESS: Engaging students has always been a key component of effective teaching. Distance-learning environments should encourage students to participate proactively by providing proximity and access to a variety of interactive tools. These can include microphones, student response devices, electronic displays and whiteboards, keyboards, mouse devices and cameras, and should be placed so as to attract, not intimidate.

CLASSROOM DIAGRAM EXAMPLE

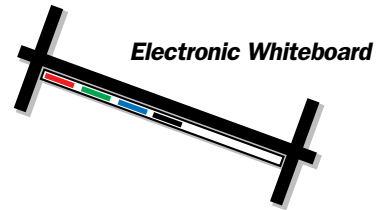
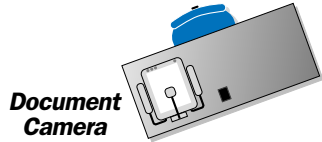
Network Interface

Peripheral

Primary System

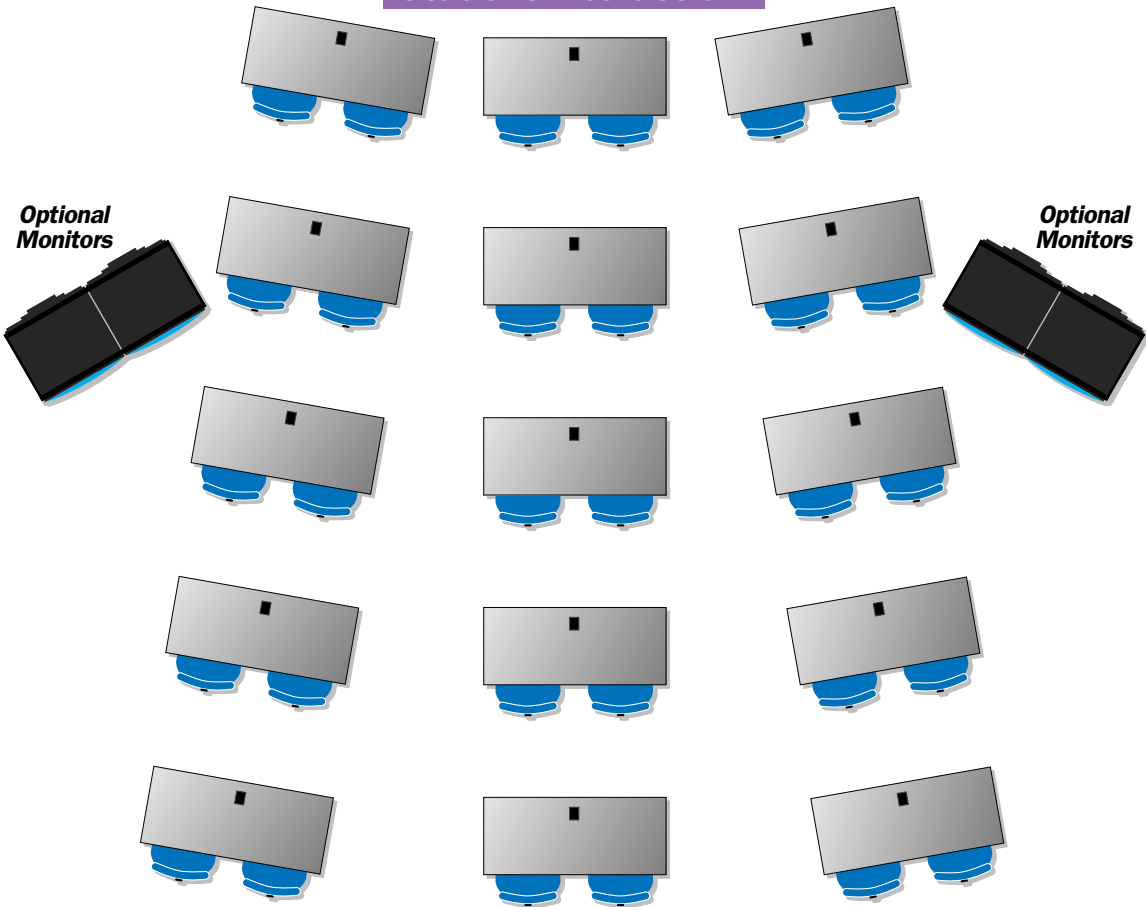
Peripheral

Instructor Workstation



Student Interaction

Optional Monitors



Presenter Subsystem



EQUIPMENT

PRIMARY ROOM SYSTEM: For general-purpose education, training and staff development, the VTEL Team Conferencing™ (TC) series videoconferencing system provides an ideal technology foundation at a very cost-effective price. The basic system consists of two monitors mounted on a mobile cabinet, which also houses the VTEL PC-based codec (coder/decoder), network interface equipment, camera, VCR and connecting cables.

Functionally, the TC platform provides:

- Superior video and audio quality at a variety of operating speeds
- Windows® 95-based operating system
- Direct connection to LAN/WAN
- Wide range of network options
- Software-based upgrades and options
- Integrated multimedia tools
- CD-ROM
- Easy integration of SMART Board and other peripheral tools

AUDIO: In addition to the base system, a sufficient number of microphones should be provided, with a minimum of one for every two students, along with an audio mixer that can accommodate multiple mic inputs. As stated earlier, this is NOT an area to cut corners. Sufficient audio amplification and sound reinforcement should be available internally via the base TC system to support good fidelity, clarity and volume. Additional sound reinforcement may be accommodated via external amplifier and speakers if needed.

CAMERAS: A minimum of two cameras should be placed in each room: one for the instructor/presenter and one for the students/audience. It is recommended that a higher-quality, auto-tracking camera be used for the instructor, mounted at or near the rear of the room. It should be located together with a large monitor displaying incoming signals from remote sites, thus facilitating direct eye contact between instructor and participants. VTEL's Presenter Camera System, which can be directly integrated into the VTEL TC system, is ideal for providing high-quality video and auto-tracking capability, allowing presenters to move about freely without concern for camera control. The student/audience camera should be placed at or near the front of the room, to provide multiple views of on-site participants. The standard integrated Canon pan/tilt/zoom camera provided by VTEL is ideal for allowing a wide range of pre-set and manually controlled settings to achieve this function. VTEL's Student Camera System provides these capabilities in a fully automated mode.

DISPLAYS: In addition to the primary TC system monitors (which are typically located at the front of the room), "slave" monitors may be recommended in larger rooms to provide students seated in back rows adequate view of inbound, outbound and graphics-based video. The TC system will drive at least two external monitors, which can be mounted either at the sides or ceiling of the room, depending on seating arrangement and structural considerations.

EQUIPMENT

STUDENT INTERACTION:

Touch-to-talk microphones will provide the primary student-teacher interaction via voice. Other modes of direct interaction are described in the “Interactive Access” section. More information about these optional devices is available through your VTEL representative or qualified distance-learning consultant.

NETWORK INTERFACE EQUIPMENT:

Dealing with the multitude of network connectivity options currently available can be a complicated task. The primary services to which access and interfacing are important are listed in the Network Connectivity section on page 10. A myriad of hardware supports this integration, including inverse multiplexers (IMUX), routers, Channel Service Units/Data Service Units (CSU/DSU), specialized modems, LAN interface cards, audio and video distribution amplifiers, RF modulators and demodulators, mixers, terminal adapters, emulators, servers, bridges and hub configurations. Selection and placement of these items should be the result of careful evaluation and design by qualified consultants and an authorized VTEL representative.

NOTE: As stated earlier, wherever possible, facility planners should leverage existing network resources to their fullest. For example, by interfacing the interactive video system with in-house cabling or satellite-received video/audio, a distance-learning system can provide a means to:

- **ORIGINATE:** redistribute video and audio programming from the conferencing room to other rooms on campus or to other campuses within the district or region.
- **RECEIVE:** bring in programs received from satellite, cable or ITFS systems for redistribution via the interactive video network to virtually any site.

OPTIONAL TEACHING TOOLS: Choosing the VTEL TC System as a foundation for classroom design affords many options for direct integration of peripherals that enhance teaching and learning. Because of its PC-based architecture and Windows 95 platform, the TC seamlessly accommodates a wide range of valuable, stand-alone tools in ways not possible with other videoconferencing systems. The following are optional peripherals currently available:

- **CD-ROM:** CD-ROM audio and video may be directly distributed to all remote sites via the TC system.
- **DOCUMENT CAMERA:** This tabletop camera device provides easy-to-use display and manipulation of documents, graphics, real-time annotation and three-dimensional objects. With VTEL's SmartView™ software, the document camera is converted into a fully automated imaging system that captures and sends “snapshots” with no user intervention.
- **SMART BOARD:** It is recommended that classrooms identified as potential teaching sites be equipped with VTEL's SMART Board system. This system relies on a familiar classroom teaching tool on-site, while distributing materials written on the board's surface interactively to all sites and displaying the materials at those sites clearly on system monitors and video displays.

EQUIPMENT

- **DIRECT LAN INTERFACE:** VTEL's industry-standard PC platform easily interfaces with local area networks and the Internet, bringing real-time global access to a wide range of information resources to the classroom and remote sites.
- **PRESENTER CAMERA SYSTEM:** VTEL's Presenter Camera offers the instructor mobility by providing automatic camera tracking without manual intervention. It employs a wireless microphone and transceiver, thereby freeing up presenters to teach in their natural and uninhibited styles.
- **STUDENT CAMERA SYSTEM:** VTEL's Student Camera system automatically zooms in on students with questions or comments when they activate their microphones. When a student removes his or her finger from the mic button, the camera automatically returns to the original full-classroom view, eliminating the need for manual camera control.
- **PEN PAL GRAPHICS®:** This exclusive VTEL software lets instructors and presenters create PowerPoint® presentations on their desktops, load them directly onto the TC system and automatically send slides to all locations, without user intervention.
- **STUDENT RESPONSE DEVICES:** A variety of stand-alone devices are available that support spontaneous interaction from multiple students and remote sites. At the student site, these devices are typically small keypads that allow for real-time response to multiple-choice and true-or-false questions or to more sophisticated querying options. On the instructor end, incoming responses are automatically compiled, manipulated and displayed, with additional statistical analysis available on some systems. This technology provides direct interaction without the interruptions, such as students asking questions, associated with real-time audio interaction. Relying primarily on standard telephone lines, these systems can be a valuable supplement to the interactive video classroom.
- **INSTRUCTOR WORKSTATIONS:** In most of today's instructional settings, an instructor podium or workstation integrates the various tools necessary for effective teaching. These should include keyboard, writing tablet or similar device, document camera, mouse, computer display, audio and mic controls, camera controls and other user interfaces. Outside consultation from a qualified integrator is advised for designing such a workstation.

SUMMARY AND CONCLUSION

A reiteration of several important points that are critical success factors in your future facilities-planning process follows:

TOTAL INCLUSIVITY IN PLANNING

The direct involvement of ALL stakeholders will be critical to meeting their expectations and ensuring long-term success. It will also enhance the likelihood of shared ownership and shared accountability.

DEFINED INSTRUCTIONAL OBJECTIVES

Planning, design and implementation of any effective distance-learning environment should be driven by clearly defined instructional needs and objectives, rather than by technology.

CRITICAL IMPORTANCE OF AUDIO

Environments that do not provide good, reliable and clearly discernible audio performance **WILL FAIL**, regardless of the sophistication or quality of associated video and data components. This is the last area in which to cut corners.

PLAN FOR THE FUTURE

Build into facilities planning the potential for network growth, cost-effective expansion of services and technology upgrades. This is best achieved by sticking to technology solutions that are standards-compliant and are based on open and flexible PC architectures that can easily be upgraded via software.

MAINTAIN THE USER PERSPECTIVE

Wise planners always put themselves in the place of their ultimate customers—the end users of their products. This is not always easy, and it is often ignored. But this principle should remain paramount throughout the design process.

SEEK OUTSIDE EXPERTISE

Do not hesitate to ask for outside help. No one individual or organization has all the answers, and there are no wrong questions. Similarly, there is no reason for YOU to reinvent the wheel or replicate others' mistakes. Your VTEL representative, authorized reseller and qualified distance-learning consultant are invaluable partners in your long-term success. Use them.

CONCLUSION

In many ways, this guide is only the beginning of what will assuredly be both a challenging and instructive experience for technology planners and facilities designers. As stated from the outset, the information presented here is intended as a foundation. It will provide a good starting point for applying proven and practical principles of room design, technology integration and development of creative instructional applications that yield positive outcomes for learning. In any worthwhile technology endeavor, there will inevitably be successes and shortfalls. The key is to take the lessons learned from both, apply them and move forward. It is hoped that this guide will assist you in those first critical steps toward true success in the new learning environment.

ABOUT THE AUTHOR

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A recognized pioneer in his field for nearly two decades, Don Foshee has designed, built and managed some of the largest and most successful distance-learning, training and telemedicine networks in the United States, all utilizing a wide range of technologies. Following his days as a Systems Analyst for NASA's early Space Shuttle program, he co-designed and was Vice President of the TI-IN Network; was Director of STAR Schools projects for statewide networks in Texas, North Carolina, Illinois, Alabama, West Virginia and Mississippi; was Director of Oregon's three statewide networks—ED-NET; and launched a Native American Network for the Bureau of Indian Affairs. During this period he was responsible for the design and installation of more than 2,000 distance-learning classrooms and facilities. All of these projects are successfully operating today, using satellite, computers, ITFS, digital compression, microwave, audioconferencing, videoconferencing and cable TV distribution.

Foshee returned to the private sector in 1992, and as Manager and Director of Strategic Programs for VTEL Corp., he built the company's first vertical divisions focusing on education and government. Upon his departure in 1995 to start his own company, VTEL dominated both markets.

Today, as President and CEO of Innovative Interactions, Inc. (i3), headquartered in Austin, TX, Foshee provides a wide range of consulting services for technology planning, networks, environmental and classroom design, legislative policy, grants, funding, public speaking, project management and technology-based applications development worldwide.

Having equal success in both public and private sectors, Foshee has also provided leadership nationally as President of the U.S. Distance Learning Association (USDLA) and more recently as founder and President of the newly formed Texas Distance Learning Association (TxDLA). Based on his own personal experiences with life-threatening illness and isolation, he has also dedicated himself to the plight of America's "forgotten learners" with special needs — the critically ill, homebound, hospital-bound and learning-impaired.

Foshee has served or currently sits on boards of the USDLA, TxDLA, ITCA, NETO, EDSAT, Texas T-STAR and Leukemia Society of America. He has written for more than 20 publications and is currently completing a book of practical guidelines for success in new learning environments. He is a sought-after lecturer/speaker and since 1994 has delivered more than 200 keynote speeches on six continents.