WHITE PAPER

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VIRTUAL LEARNING IN HIGHER EDUCATION

Evolving campus technologies increase interaction, broaden campus reach and offer efficiency savings.

Executive Summary

Once viewed as an add-on to traditional instruction, virtual learning has become an essential component of higher education. Online elements and digital content are now integral parts of college classes in all fields. Many institutions also offer an increasing number of courses entirely online.

Virtual-learning programs are efficient and cost-effective, which are important factors at a time when higher education and student budgets are tight.

The proliferation of mobile devices and students' expectations that they can work anytime, anywhere are pushing virtual-learning programs to offer mobile versions of their applications and make infrastructure upgrades to ensure high availability. Because they serve a generation connected by Facebook, Twitter and other social-networking technologies, effective virtual-learning programs include multiple communication channels, such as chat, blogs and wikis — vehicles that allow for student-to-instructor and student-to-student interaction.

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Virtual-learning Growth

Barriers are falling that once separated virtual learning from the traditional educational experience centered on face-to-face interaction in classrooms and lecture halls. In a survey conducted by the Pew Research Center, 15 percent of college presidents say that a majority of their students have taken at least one course online. In the same study, 50 percent of those college presidents say that 10 years from now, a majority of students at their institutions will take some classes online. This future is taking shape at the Minnesota State Colleges and Universities system, which has set a goal that online courses represent 25 percent of the credits earned from its 54 institutions by 2015.

It's not just that college students are beginning to mix virtual courses into their schedules. The trend toward using digital content and online elements to enhance traditional courses in all fields is also strengthening. An increasing number of institutions now offer a blend of virtual and in-person classroom learning, with some components available in person in the classroom and other pieces available online.

The aim is to combine the best aspects of each approach. Ideally, classroom time is devoted to advanced interactive experiences with the instructor and other students, while the virtual portion of the class adds the flexibility and independence of self-paced learning. At the University of Central Florida in Orlando, for example, more than half the 56,000 students already take at least one of the university's 2,500 online or blended courses.

Colleges and universities are also incorporating virtual learning into their continuity of operations (COOP) planning. Institutions in the nation's snowbelt have found that web conferencing can reach students even when they or their instructors can't reach campus.

Virtual learning gives students far more control over their own education. The scheduling flexibility lets them learn when it's convenient for them and at their own pace. Students looking to recover credits lost through a transfer from another college or previous academic difficulties can use online courses to fill those gaps in a way that fits their schedules. These are significant considerations for students of all ages, but are especially important to working adults who have to juggle college, home and professional lives.

Different Interaction Pathways

In a virtual-learning environment, the typical interaction dynamic changes. Students direct and set the pace of learning. And a well-designed virtual-learning environment is much more interactive than the traditional lecture experience. Some examples include e-mail, chat, file and desktop sharing, web conferencing and Facebook. The new tools offer opportunities for one-to-one communication between an instructor and a student; online venues for small-group collaboration, review or discussion; and new pathways for distribution of lectures, announcements or any kind of digital content to a broader audience. The big advantage is that none of these options are limited by the time constraints of a class schedule.

Finding the Right Blend

A blended course can be anything from a traditional lecture class in which the instructor shares a file of background notes over the Internet to a course in which most of the content is delivered online with a few face-to-face discussions with the instructor. Here are some questions to ask for instructors and course planners to find the right blend:

- What are the learning objectives of the course, and which learning mode can best meet them?
- What technology is available to support virtual elements?
- What skills are available from instructors, IT staff and students?

Finally, remember that a clear course structure and integration between virtual and face-to-face elements are essential to an effective learning experience.

Technologies for Virtual Learning

Most virtual-learning technologies fall into three broad categories. These are not precise divisions — technologies and functionalities overlap as each category evolves.

Lecture capture: These technologies have come a long way from their roots in rough audio and videotape recordings of class sessions.

A lecture capture system (LCS) records every aspect of the presentation, including all the ancillary materials, such as PowerPoint slides, interactive whiteboard annotations or output from a document camera. The recordings are then edited and annotated to create rich, complex presentations for asynchronous viewing by students. Many lecture capture systems also stream live audio and video, offering remote real-time access to the presentation.

In a software-based LCS, an agent is downloaded onto the presenter's computer, which is networked with the other hardware (microphone, video camera and interactive whiteboard) used for the session. The software agent integrates the output from the various tools, including keystrokes on the speaker's computer.

When the edited recording of the session is complete, the LCS automatically distributes a link to students registered in the course and others on a predetermined distribution list. Instructors can also release the lectures on a set schedule.

Many systems include tools that promote student interaction, such as polls or requests for responses to the captured content. Results of the polling and student commentary are then integrated into the presentation. They also offer high-definition recording and playback at a pixel resolution of 1920x1200 or better.

Webinars: These interactive online presentations are usually delivered first in real time and then recorded and made available for review or first-time viewing by a new audience. With their highly structured format, webinars offer an excellent platform for professors to tighten the class focus or expand on important topics in the course. The original live sessions usually feature question-and-answer components, either via voice or text chat. At Northeastern University in Boston, for instance, a professor uses a weekly webinar to provide extra guidance in an online graduate educational administration course in organizational change.

Using remote desktop sharing, instructors can talk students through complex topics while using a variety of tools and applications to display information on their computer screens.

The technology needed to support a webinar varies with the technical complexity of the presentation. Webinars work best if everyone in the audience has a high-speed Internet connection. There are many stand-alone software offerings on the market that let colleges or instructors create and deliver webinars. That functionality is also available in many course or learning management systems. Hosted webinar applications are also available as cloud services.

Interactive web conferencing: Most web conferencing systems are based on two-way communication over a distance, with the Internet providing the link between locations. Interactive web conferences can range anywhere from an online chat about homework to a lecture delivered via telepresence.

Colleges and universities often use interactive web conferencing to extend the geographic reach of classes, lectures and meetings. Web conferencing can let a professor or expert speaker deliver a lecture simultaneously to multiple classrooms located on separate campuses in various parts of the country (or world) and respond to questions from students in any of the locations in real time. For instance, West Hills Community College District in California uses web conferencing to offer real-time instruction simultaneously to students at the college's three campuses in Lemoore, Coalinga and Firebaugh, as well as at the Lemoore Naval Air Station.

The requirements for the most basic forms of interactive web conferencing are pretty simple: a software application and an Internet connection. Many colleges use web conferencing for virtual-learning courses, virtual review sessions for traditional or blended classes, or collaboration among professors and/or students at separate sites. The technologies necessary to support web conferencing are readily available: microphones; webcams or digital video cameras; network connections to stored content; and additional hardware tools such as document cameras, projectors and interactive whiteboards.

Security Considerations

As IT departments at colleges expand their virtual-learning environments, most recognize they need to upgrade their security systems as well. Multiple layers of protection are especially critical when educational resources are delivered to many users in widespread locations who are using a wide variety of devices.

Deploying application level firewalls is a good place to start. They offer deep packet inspection, impose specific policies for individual applications and securely enable increased network speed and throughput.

The various devices students use to access virtual-learning systems can also become breeding grounds for unwanted content, viruses and other types of malware. Web and e-mail filtering tools are essential for blocking access to suspicious or prohibited websites and for keeping inappropriate content from traveling over the college network. Antivirus software is a must and should be updated regularly on all user devices.

Finally, deploying secure network access control (NAC) software ensures that only authorized users can connect to the network. NACs regulate access to network resources by requiring one or more forms of authentication. Most NACs automatically enforce endpoint security policies by blocking access to the network if a password has not been changed within the period stipulated by use policies or if the device is not protected by the latest antivirus update. These systems also add an extra layer of filtering to block malware.

Building the Virtual Environment

When choosing technologies to support the growing number of virtual and blended offerings in course catalogs, colleges should consider some key issues:

- **Integration with other technologies:** The lecture capture system must work not only with the learning management system, but also with the existing infrastructure and AV equipment.
- **Versatility:** The technology environment should be able to publish course content in many formats and provide multiple communication channels.
- **Scalability:** The technology chosen should not limit the expansion of the virtual-learning environment.
- **Path to upgrade:** It's essential to have a plan for keeping up with rapidly evolving virtual-learning technologies.

Instructor Support and Training

Training for instructors is critical for virtual-learning programs to succeed. Regardless of how training is delivered, instructors need professional development and guidance in three crucial areas.

Technology: Mastering the mechanics of using virtual-learning tools is essential — instructors who can't use the technologies with confidence won't exploit their full educational potential.

Design: Instructional technologists or design specialists can show how to match learning objectives to appropriate technologies and to create courses rich in interactive elements and opportunities for collaboration.

Interactivity: Instructors in virtual-learning environments often spend two or more hours a day interacting with students online. They need guidance on how to manage the interactions and use communication tools effectively.

Infrastructure Upgrade

A growing virtual-learning environment makes heavy demands on the IT infrastructure, which must maintain high availability for all applications and resources. Increased traffic and bandwidth-intensive applications, such as streaming video, require optimized wired and wireless networks, as well as additional server and storage resources.

To optimize the use of existing network resources, institutions should upgrade switches and deploy network management software. These systems monitor network traffic and application performance and send out alerts when transmission speeds or application availability approach predetermined performance minimums.

Students now bring multiple wireless devices to campus through which they expect to access virtual-learning systems. To meet increased bandwidth demands, colleges should consider upgrading their wireless networks to the 802.11n protocol. Wireless N promises up to 10 times the transfer speeds and twice the range of networks using earlier versions of the 802.11 standard.

The growth of digital content and increased traffic to and from applications in the virtual-learning environment requires optimized server and storage resources. Consolidating the server infrastructure through virtualization and updated management tools can reduce hardware costs and headaches, especially as web and application servers multiply.

The need for high availability requires most colleges building virtual-learning environments to use networked storage, either a storage area network (SAN) or network-attached storage (NAS). SANs offer storage virtualization, which presents all the storage devices on the network as a consolidated storage resource that can be centrally managed. Stand-alone storage virtualization products are also available.

Course Development

Higher education institutions should follow a step-by-step process for exploiting the potential of digital technologies as learning tools.

Determine objectives. As in a traditional face-to-face classroom course, the first step in developing a virtual-learning course is to determine the ultimate educational objectives and skills students must master. Those skills will likely include critical thinking and learning to use technology to achieve educational goals.

Conceptualize the course. Once the overall course objectives have been determined, conceptualize the course in painstaking detail, keeping in mind the technologies available. The instructor or team developing the virtual-learning course defines specific objectives for each unit or session of the course and then matches those goals with an appropriate technology to help students achieve the objective.

Create the course. Executing the concept means working through the course or learning management systems to create (or gather), assemble and schedule all the elements of the virtual-learning experience. In addition to the academic subject matter, the course has to deliver logistical and housekeeping information, such as the syllabus, grading policies, and information about how the software works and where to find technical support.

Test the course. Ideally, testing the course should be a two-part process. The instructor or the designer, working with the IT staff, should go through the course and all related materials to make sure the technology works and that it presents the course as it was conceptualized. If possible, they should follow the test with a pilot.

Go live and get feedback. A good virtual-learning course isn't finished even after it goes live. Gathering feedback from students and instructors will help resolve problems and identify areas for improvement as the course evolves. Virtual courses should be tweaked once a year, and a major revision should take place every three years to keep the content and delivery fresh.

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