

VIRTUAL LEARNING IN K-12 EDUCATION

Evolving classroom technologies offer greater flexibility, interactivity and independence.

Executive Summary

Once viewed as an add-on to traditional instruction, virtual learning has become an essential component of K-12 education. Online elements and digital content are now integral to the curriculum at all grade levels. Many schools also offer an increasing number of courses entirely online.

Virtual-learning programs are efficient and cost-effective at a time when school district budgets are tight. In addition, they can help stretch teaching resources that are in short supply.

Students today increasingly expect to access learning resources anytime and anywhere using an array of mobile devices. Virtual-learning programs help schools keep pace by offering mobile versions of educational applications and making infrastructure upgrades to ensure secure mobile access and high availability. Multiple communication channels for student-to-teacher and student-to-student interaction have also become essential features in virtual-learning environments, built to serve a generation connected by all of the social networks.

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Virtual-learning Adoption

Barriers are falling that once separated virtual learning from the traditional K-12 approach centered on face-to-face classroom interaction. Thirty percent of high school students and 19 percent of middle schoolers took at least one online class in 2010, according to a 2011 report sponsored by the national nonprofit group *Project Tomorrow*. Scheduling flexibility, control over their own learning and the ability to work at their own pace were the top benefits cited by students who had taken virtual courses.

It's not just that students are beginning to mix virtual courses into their class schedules. The trend toward using digital content and online elements to enhance traditional classes is also strengthening. An increasing number of schools are offering blended courses, combining elements of virtual and live classroom learning. In some blended classes, like those at the VOISE (Virtual Opportunities Inside a School Environment) Academy, a Chicago public high school, students work almost entirely online even when they are in school, with the teacher available in the classroom for guidance and one-to-one mentoring. The aim is to combine the best aspects of each approach: face-to-face contact with the teacher and other students enhanced by the flexibility and independence provided by the virtual portion of the class.

School districts are also incorporating virtual learning into their continuity of operations (COOP) planning. Schools in the snowbelt region of the country have found that virtual-learning technologies can reach students even when no one can make it to school.

Virtual learning gives students more control over their own education. Scheduling flexibility lets them move at their own pace and learn when it's convenient for them. When a part of the curriculum sparks special interest in a student, he or she can explore it in more depth online. Customized, learner-centric

Finding the Right Blend

A blended course can be anything from a traditional class in which the teacher 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 teacher. Here are some questions to ask for schools looking 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 teachers, IT staff and students?

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

education works best for every student, but it is particularly important for those with disabilities and special learning needs.

Different Interaction Pathways

In virtual-learning environments, the typical interaction dynamic changes. Students can set the pace of their own learning. And a well-designed online course is actually more interactive than the traditional classroom experience. Technology provides many more channels of communication than are possible in traditional classroom settings.

Some examples include e-mail, chat, file and desktop sharing, web conferencing, and Facebook groups. These new tools offer opportunities for one-to-one communication between a teacher and a student; online venues for small-group collaboration, review or discussion; and new pathways for distribution of digital content and announcements to a broader audience – all without the time constraints of a class schedule.

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. Lecture capture system (LCS) use involving hardware and software tools to record fully integrated presentation began at colleges and universities, but K-12 districts are catching up. Lecture capture can stretch teaching resources and enrich the curriculum by building a growing store of reusable digital resources. The Cornwall-Lebanon School District in Lebanon County, Pa., adopted an LCS two years ago as a way for its more than 4,700 students to both receive information and create presentations.

An LCS records every aspect of the speaker's presentation, including all the additional 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, providing remote real-time access to the presentation.

Lecture capture lets students catch up on or review class content whenever it's convenient for them. The edited recording can be integrated into a virtual-learning environment and thus becomes a component of a fully online or blended course.

In a software-based LCS, an agent is downloaded on 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 is complete, the LCS automatically distributes a link to students registered in the course and others on a predetermined distribution list. Teachers 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. Current LCS systems 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. In K-12 districts, webinars are most often used as training vehicles for instructors, though creating a webinar is a common assignment for students in virtual courses in the higher grades. With their highly structured format, webinars offer an excellent platform to focus or expand on important topics.

Most webinars consist of PowerPoint slides that are accompanied by audio explanation by the teacher. Audio is delivered over a standard phone line or streamed via Voice over Internet Protocol (VoIP). Using remote desktop sharing, teachers 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 that let schools 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: This technology takes many forms, but the main focus is 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. But even in its most basic forms, these technologies deliver real-time interactivity over distance.

School districts often use interactive web conferencing to extend the geographic reach of classes. Web conferencing can let a teacher or expert speaker deliver a lecture simultaneously to multiple classrooms anywhere in the world and respond in real time to questions from students at all locations. The North Slope Borough School District, which is administered from Barrow, Alaska, but includes seven villages spread over 88 square miles, uses video conferencing to deliver courses from Barrow to the secondary schools in each small community.

Building the Virtual Environment

When choosing technologies to support the growing number of virtual and blended offerings, schools 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.

The requirements for the most basic forms of interactive web conferencing are pretty simple – a software application and an Internet connection. Some districts use web conferencing for virtual-learning courses, virtual review sessions for traditional or blended classes, or collaboration among teachers or students at separate sites.

Security Considerations

As IT departments at schools 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 that 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 school's network. Antivirus software is a must and should be updated regularly.

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 user 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.

Instructor Support and Training

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

Technology: Mastering the mechanics of using virtual-learning tools is essential – teachers 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 create courses rich in interactive elements and opportunities for collaboration.

Interactivity: Teachers 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 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, districts 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 expect to access virtual-learning systems, along with other school computing resources, through their mobile devices. To meet bandwidth demands, districts should consider upgrading 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 will require most districts building virtual-learning environments to use networked storage, either a storage area network (SAN) or network-attached storage. 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

School districts should follow a step-by-step process for exploiting the potential of digital technologies as learning tools.

Determine objectives. As in traditional curriculum planning, the first step in developing a course for virtual learning is to determine the ultimate educational objectives and the 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 system (LMS) 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 how the student can get technical support.

Test the course. Ideally, testing the course should be a two-part process. The teacher 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 testing with a pilot, in which a limited group of students and the teacher test the course as a real-life learning experience.

Go live and get feedback. A good virtual-learning course isn't finished even after it goes live. Gathering feedback from students and teachers 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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