Videoconferencing K-12: The State of the Art

by Scott Merrick

In an online document illustrating "The Technology Adoption Life-cycle" (n.d.), Fred M. Beshears presents a model for understanding how educators adopt new technologies in their work. Drawing upon a bell curve graph developed by G. A. Moore (1991) to trace different segments of the technology market, Beshears suggests that the adoption of technology by educators follows a similar pattern. Beginning with the "Innovators" and "Early Adopters," the curve includes a "Chasm"—a sort of no-man's land between those early groups and full adoption—as well as a group termed the "Early Pragmatists"—whom Beshears describes as "the solid citizens who do not like to take the risks of pioneering, but are ready to see the advantages of tested technologies. They are the beginning of a mass market" (para. 4). Interactive videoconferencing (IVC) hardware and software manufacturers are betting millions on the emergence of a mass market for their wares, and educators now make up a substantial segment of this potential market.

To most educators the use of IVC—synchronous audio and video communication between people located at a distance from one another—in the classroom still qualifies as a cutting-edge innovation. However, to a growing group of teachers, administrators, and technologists, IVC is rapidly becoming a tool as pervasive and accessible as the Internet itself. This article will outline the advantages that IVC provides for teachers in K-12 education, identify resources and research for those interested in using this technology in their teaching, and assess the current potential of videoconferencing to be implemented on a wider scale by K-12 teachers.

Benefits of IVC in the K-12 Curriculum

A teacher new to the concept of IVC might well bring a critical eye to this technology. After all, current K-12 trends toward "teaching to the test" in an era of accountability assessment through standardized testing call for thorough validation of IVC's efficacy as a teaching tool. Yet as a supplementary tool for teachers, IVC technology bears substantial potential for fostering a richer, more comprehensive K-12 curriculum, bringing to any classroom extraordinarily rich resources simply not otherwise available.

For example, IVC offers help for classroom teachers who may lack knowledge or experience needed to teach a particular subject. Teachers are human beings. No matter how well they are trained to do their jobs, it is a rare teacher who feels totally comfortable delivering instruction in every content area. Some are stronger in literacy instruction, some in mathematics, and some find their comfort zone teaching science. Especially in elementary grades where teachers in self-contained classrooms are expected to be experts in every field of knowledge, IVC can bring supplemental resources into a classroom at little or no cost, once the equipment is purchased and properly configured. These resources can help broaden the scope of instruction in any subject area.

In turn, IVC brings a welcome change of pace to the prevailing instructional style in any classroom. A 20 minute presentation by an expert in any field can provide, in a novel and motivating way, richer content than can the same amount of time in the same old teaching style by the same old teacher. Students are human beings too. They respond positively when given the chance to discuss, for example, how stars are born or what space travel is like with a premier research astronomer who is both cognizant of their level of development and interested in reaching them on that level.

That the preceding examples are space science related is no coincidence; for three years I served as facilitator for the "VIA Dyer" (Videoconferencing Interactions with Astronomers at Dyer) series that provides students across the nation with weekly videoconference presentations from scholars at Vanderbilt Dyer Observatory. During this series I witnessed several repeat presentations on the same topic, and one excellent example is Bob O'Dell's "Astronomical Observatories"—a fascinating overview of extra-Earth telescopes including a discussion of why they are needed. In the ensuing question and answer sessions, I sometimes heard O'Dell receive the same or similar questions in subsequent sessions. While his answers would often be informed by his earlier ones, every time I heard him construct a new response, it was in some way different—and often more substantive, more interesting, or more age-appropriate—than the answers he had given before. Not only was he getting better at IVC, but he was also so obviously passionate and

knowledgeable about his topic that he inspired genuine engagement among his audience. It was not a canned presentation; it was conversation.

For example, in the course of his presentation, O'Dell often narrated a three minute computer-generated virtual fly-through of the Orion Nebula. While students could use Google to find and download this digital video from the Internet, with IVC they could see it and also simultaneously hear narration by the man who directed the 500-personhour team that actually *constructed* the animation. O'Dell's team constructed the animation out of mathematical models and images sent back to Earth by the Hubble Space Telescope, and O'Dell himself was project scientist for the first team that undertook the design of the Hubble telescope. IVC affords students a unique opportunity to interact with someone immediately involved in current research in a given discipline.

One other phenomenon that helps teachers see the potential for using interactive videoconferencing is its proponents' practice of documenting interactions on the Internet for parents and for other teachers. IVC is such a visual process that simply describing it with words does not do it justice. Video examples can help fill that gap. My own school, University School of Nashville, dedicates a Web site page to videoconferencing, and readers can visit it anytime to see brief video clips and "Web celebrations" of some of our past events. Other schools similarly document their videoconferencing projects on their own Web sites. Some examples are:

University High School (CA) and Indiana School for the Deaf's SOAR-High Videoconference, and Berrien County (MI) School District's SouthwestNet Distance Learning Collaborative.

- Bryant Elementary (CA) School's Ghostwriter project,
- Schenectady (NY) City School District's "All Projects" pages,

At my school's celebration page, noted above, one of the projects particularly demonstrates how incredibly powerful IVC can be when implemented thoughtfully and carefully. A brief description of the year-long project can illustrate one "flavor" of best practice using the technology. The TheatreLink Project (now in its fourth year) brings together drama classes in high schools all over the country. Each class works with a playwright from the project's sponsor, the Manhattan Theatre Club, collaborating via IVC, e-mail, online chat, and electronic bulletin boards they have completedl a short play. The students then pass their play to another participating school and, in turn, receive the play written by students there. Each school then works, using the same tools, with a professional director to fine tune a production of the play they have received. In the final activity, schools present the play they have produced over IVC for the students who wrote it. Clearly, for this project and for so many others, interactive videoconferencing enables a level of collaboration and coaching that would be impossible without it.

IVC Resources and Opportunities for Collaboration

While K-12 videoconferencing may occupy a low priority level among national policymakers, it has no shortage of regional supporters who are attempting to speed along its adoption. "Clearinghouse" organizations have established Web sites around the country in an effort to make finding relevant resources less time-consuming. These groups also strive to position themselves as centralized locations for content providers (museums, art centers, science centers, etc.) to advertise their programs and schedules.

One of the most developed of these is the Center for Interactive Learning and Collaboration (CILC). Rising out of telephone company decentralization during the late '90s as a grants-based effort to coordinate statewide K-12 IVC collaboration, this Indiana organization was one of the first to offer educators options to seek out "informal educator" programs by provider or theme and to customize the search by grade level, subject area, or any combination of several search criteria. Teachers may also post calls for collaborative classroom-to-classroom projects or search through archives of those already posted. Currently scheduled programs may be selected and registration for them completed, all at CILC's Web site. Presently CILC services are free, but many of the providers charge nominal fees. School administrators who have reservations about the nominal fees need only compare the cost of a "real" field trip to a zoo or museum (assuming one is locally available) with the cost of the IVC programs—as well as consider the amount of

instructional time loss in a "real" field trip compared to a virtual one—to realize the substantial educational benefits such programs can offer relative to their cost.

Other online-accessible services do a commensurately good job of sharing opportunities. These include Two-Way Interactive Connection in Education (TWICE) in Michigan, Knowledge Network Explorer (KNE) in California, Digital Bridges in Oregon and the Northwest, and Global Leap in the United Kingdom. TWICE focuses primarily on promoting and supporting "collaborative connections using two-way interactive video for the benefit of Michigan students" (2005, para. 1)—but in the course of so doing, it provides plentiful resources for anyone interested in learning more about the technology. KNE provides perhaps the foremost listserv dedicated to interactive videoconferencing: "ed1vidconf," an automatic e-mail newsletter system utilized by content providers and individual teachers to promote and to learn about new IVC programs. Digital Bridges has evolved into a valuable resource site for both "Web-based learning" and videoconferencing. Its examples and collaboration resources are ones all new implementers could add to their arsenal of tools. GlobalLeap connects U.K. students with one another and with content providers both nationally and internationally. The site is so international in flavor that it provides a link to world time zones on its welcome page. Increasing content availability is another factor driving adoption; a quick trip to any of the above Web sites yields substantial offerings in almost any category or theme.

Colleges and universities are also exploring ways to offer outreach to K-12 schools, through efforts such as those by the Vanderbilt Center for Science Outreach (CSO). Through the Center, nearly a score of high-end videoconferencing units have been placed in Metro Nashville (TN) public schools in recent years. The Center strives to be its own kind of clearinghouse by helping to manage, through in-classroom as well as videoconferencing programs, some of the outreach requirements that are becoming commonplace in any newly awarded scientific research grant. The CSO delivers dozens of free IVC programs to schools nationwide every school year. Vanderbilt K-12 outreach is not limited to science alone: the Vanderbilt Virtual School offers an ever-changing gamut of IVCs in the humanities at its own Web site.

Research

The International Society for Technology in Education (ISTE) recently released a book that offers, along with a brief history of technological developments in the videoconferencing field, a view of how educators are using technology. Educators utilize audiovisual codec technology (the integrated circuit or chips that convert analog audio/video data to digital and reassemble it all at the receiving end) to bring experts from all fields of learning into their classrooms and to take their students into distant places—all without travel from place to place and all without the scheduling, expense, and security issues that travel involves. In *Videoconferencing for K-12 Classrooms: A Program Development Guide* (2004), Camille Cole, Kecia Ray, and Jan Zanetis describe the increasing prevalence of this tool as a means of connecting students in an efficient and economical manner with the "real world" outside classroom walls. The book's appendices offer a wealth of resources and checklists for making IVC experiences successful. One indication of the book's success (and yet another indicator of the ongoing adoption of IVC in K-12 school setting) is a recent interview with Zanetis in *Education World* (Jackson 2005).

A growing body of research indicates that IVC instruction, when delivered well, is at least as good as in-person classroom instruction. The title of Thomas L. Russell's annotated bibliography *The No Significant Difference Phenomenon* (2001) might appear to be bad news for adopters, but its findings, extractions from 355 different research analyses focused on distance learning outcomes compared to traditional classroom ones, actually underscore what common sense might lead us to expect: the *way* a topic is taught is much more important than the *vehicle* used to deliver the teaching. It can be argued that since this is the case, one might as well utilize technology to deliver content, as long as the material is delivered in a thoughtful, carefully conceived and executed manner.

Russell's controversial study (used by proponents on *both* sides of the traditional versus technological debate) is cited in an article called "Navigating the Sea of Research on Video Conferencing-Based Distance Education: A Platform for Understanding Research into the Technology's Effectiveness and Value" (2004). Wainhouse Research, the agency responsible for Alan Greenberg's incisive paper, offers an extremely rich well of research resources at their newly-mounted Web site, WRP Platinum (registration required) in the form of complete whitepapers such as "Merging

Live Conferencing with Collaborative Group Workspaces" (2005), "Best Practices in Live Content Acquisition by Distance Learning Organizations" (2003), and "The Business Case for Videoconferencing: Understanding the Benefits, Costs, and Risks of Videoconferencing Over ISDN and IP" (2002). These resources provide the sort of detailed analysis and documentation that can help an institution's IVC advocate convince administration and faculty that interactive videoconferencing is not just a trendy new technology.

Technological Advances and Cost Factors

An additional factor driving the growth in K-12 IVC is the relatively recent emergence of increasingly reliable IP videoconference connectivity. Historically, the cost of maintaining dedicated telephone lines for ISDN videoconferencing connections has been a major obstacle to adoption in schools. Line fees can range into the hundreds of dollars per month for a resource that may be used only once or twice a month; school administrators have had a hard time justifying that expense, especially considering that many connections also involve long-distance charges. Now that IP connectivity is more readily available and codecs are offering higher rates of compression (thus more available bandwidth), more content providers are offering IP-delivered programs. As a result, more schools can consider equipment purchases.

Getting started with IVC may require a school to invest approximately three to five thousand dollars. While desktop solutions like SightSpeed, iVisit, and even Yahoo!Messenger, Microsoft Messenger, and AOL Instant Messenger can provide increasingly consistent connections for one-to-one planning sessions or casual conversations (see my Desktop IVC Sharesite and, more specifically, the Online Session Document accessible from that site, for detailed discussions of those possibilities), the higher-end solutions (Polycom, Tandberg, Sony, etc.) are generally perceived to be required in order to include all parties in an interaction where at least one end of the conversation contains a room full of people. Additionally, most content providers use the codecs in these high-end devices to present their content, and standards are not yet such that all these systems "play fairly" with one another. Tandberg and Polycom offer substantial grant-writing assistance to help supplement a school or school district's budget toward entering the age of Interactive Videoconferencing.

Further Steps towards Integrating IVC Technology in K-12 Education

In the fall of 2004, the first national conference dedicated to IVC in K-12 classrooms was held. The Keystone Conference, centered in Indianapolis, was attended "virtually" by an estimated "1,400 people from five countries and 35 U.S. states" via IVC with 160 attendees present locally (2005, 1). Conference presenters, many of whom were content providers, offered informative sessions both from Indianapolis and from their remote locations. Each presenter who was also a content provider was required to create a brief "Public Service Announcement" for airing in between conference presentations (for example, see Vanderbilt's four minute presentation in Exhibit 1). Plans are already in full swing for the second such conference, also to be "located" in Indianapolis, on October 3-5, 2005.

Another powerful sign of IVC's growing prominence was its significant presence at the International Society for Technology in Education's (ISTE) annual National Educational Computing Conference (NECC), held in the summer of 2004 in New Orleans, Louisiana. Of the over 170 workshops being held for the estimated 15,000 educators and technologists who attended, 39 of them featured live demonstrations of ways to use videoconferencing for educational enhancement. Additionally, 18 "K-12 Interactive Videoconferencing Showcases" were offered, and a commensurate number of the 265 "concurrent sessions" either featured its use or relied, in some measure, upon the technology. Videoconferencing content providers and vendors were also highly visible on the convention exhibit floor, where vendors from all over the country vied for prominence in the hearts and minds of administrators and technology coordinators—the people who make decisions about what to purchase in order to implement interactive videoconferencing in their schools or districts.

At an NECC "birds of a feather" session for K-12 videoconferencing proponents, one advocate suggested that we need a national focus on its adoption, primarily in the service of leveling the educational "playing field" between urban and

rural school systems. Administrative focus on Internet connectivity achieved nearly universal K-12 access to the Internet. Why could we not achieve the same access to videoconferencing for all students in our nation?

Another NECC IVC proponent mentioned the need for increased bandwidth availability, possibly through Internet2 or even via some other dedicated pipeline, as well as the need to make IP connectivity through the maze of security systems more "user friendly." Still another suggested that a new organization dedicated to K-12 videoconferencing be established along the lines of the United States Distance Learning Association (USDLA), which itself mainly focuses on higher education implementations and has a broad scope, entailing all kinds of distance learning delivery. All of these measures would help, and it may be that just one of them would be what NECC 2004 keynote speaker Malcom Gladwell calls the "tipping point," the event that makes the crucial difference in popular and irrevocable adoption.

At the NECC 2005 conference in Philadelphia, over 18,000 attendees gathered to discuss all manners of technology innovations, and once again IVC was a prominently featured technology. Most tellingly, the growing impact of IVC in the field of education was so deeply felt that a new members' special interest group (SIG) was formed: The SIG-IVC, led by the aforementioned Jan Zanetis along with Camille Cole and Ruth Blankenbaker, currently consists of 100 ISTE members and is projected to grow exponentially now that it has achieved official SIG status. ISTE members—over 85,000 educators, technologists, and administrators—are encouraged to join at least one SIG of the nine currently available.

Conclusion

Whatever steps are taken next, it is clear that first ones have been set squarely in place, and as a result, the light is brightly shining at the end of the "Chasm." I believe that we already have our collective feet planted firmly on the first ground of widespread adoption. Strides continue to be made, implementers continue to adopt and utilize IVC to accomplish their own educational objectives, and hardware and software technologies continually improve. Meanwhile, the good news for all of our students is this: interactive videoconferencing is here to stay.

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