Taking the Wraps off Videoconferencing in the U.S. Classroom

A State-by-State Analysis

Wainhouse Research

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TANDBERG

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Executive Summary

This white paper measures videoconferencing adoption in K-12 schools as of mid-2006, and attempts to answer several questions: what is the extent of adoption in any particular state, and how many schools and classrooms are likely to be enabled for professional-quality videoconferencing on a national and state-by-state basis. The data was gathered over several months via primary and secondary research, with numerous online resources contributing to a counting process, more than 40 end user and organizations contacted via email or phone, and via conversations with numerous equipment manufacturers, state network providers, and resellers.

Wainhouse Research believes that close to 23,000 public, primary and secondary school classrooms or administrative offices have been equipped with videoconferencing as of early 2006. *Correlating this number to the more than 92,000 public schools in the U.S. suggests that about 25% of U.S. schools have adopted videoconferencing.*

Typical estimates for the average number of K-12 classrooms per school range from 25 to 32. Conservatively accepting the lower number would suggest that approximately 2.3M classrooms exist in the U.S. (25 x 92,000). This means that videoconferencing, in terms of the aggregate number of classrooms in the U.S., has achieved about a 1% penetration rate.

In terms of total video-enabled classrooms and offices, California, Texas, New York, Oklahoma, and Ohio have led the way, followed closely by Florida, Indiana, Wisconsin, Missouri, and Pennsylvania (in that order). An additional 13 states have between 250 and 500 classrooms and offices; another 17 states have between 100 and 250 classrooms and offices. A total of 11 states have fewer than 99 video-enabled classrooms.

In terms of the percentage of schools per state that are videoconferencing-enabled, the two most geographically isolated states in the nation, Hawaii and Alaska, have the greatest penetration. Other top-ranking states include the densely populated leaders (Texas, New York, Ohio, Indiana, and California) as well as the highly geographically dispersed (Oklahoma, South Dakota, North Dakota, Kansas, Wyoming, and Wisconsin, among others).

As of early 2006, 35 of 50 U.S. states are Internet2 Sponsored Educational Group Participant (SEGP) states. One theory explaining why videoconferencing has not been adopted in some states is that those states are not yet SEGP states. This is not borne out by a comparison of the Internet2 K20 Initiative Connectivity Survey and our data. We believe more can be done at the state level to take advantage of videoconferencing in key SEGP states.

For almost 20 years videoconferencing in K-12 classrooms has been adopted in a number of growth stages, or waves. Wave 1 consisted of using videoconferencing in K-12 to access remote resources. Wave 2, which is currently cresting, has consisted of the shift to IP technologies and an explosion of content providers delivering rich resources to the classroom. Wave 3 will consist of increased student collaborative projects and even student creation and delivery of content.

While current leaders will likely continue to set the pace, less geographically isolated districts that have previously not emphasized videoconferencing technologies may be increasingly motivated by economics and evolving content and applications to implement new programs. Technology funding initiatives and increasingly compelling content may motivate legislators and school boards in lagging states to review their implementation strategies. The relatively high adoption rates in diverse states suggests that there are compelling educational benefits and business models for states with high and low populations, whether concentrated or dispersed. Ultimately, the promise of student-driven, collaborative, problem-solving activities will begin to mirror and perhaps even surpass the use of video in the global workplace.

Overview

This white paper measures videoconferencing adoption in K-12 as of mid-2006, and attempts to answer several questions: what is the extent of adoption in any particular state, and how many schools and classrooms are likely to be enabled for professional-quality videoconferencing on a national and state-by-state basis.

Why is this information important? For one, it allows content providers (museums, zoos, research labs, and other informal educational organizations) and others to assess the potential markets for their services. Many content providers in recent years have transformed themselves into national and global resources for schools, and find themselves struggling to understand how and to what extent the demand for their services will continue.

This information can serve as an informal report card that may prod some states to examine how they are faring in comparison to their peers – and to consider what can be done to improve the planning, funding, purchasing, and deployment processes.

Finally, the information may help practitioners of video in the classroom – namely, educators themselves – to understand why their field seems so exciting and full of promise in pockets, and yet why they sometimes feel like they hit brick walls when approaching colleagues in other states or regions about videoconferencing as an educational tool.

Historical View

For almost 20 years videoconferencing in K-12 classrooms has been adopted in a number of growth stages, or waves. The first wave of use of videoconferencing in K-12 began in the late 80's/early 90's, and predictably arose for the most pressing reason: access. Many rural states funded statewide networks that often included mixtures of higher education, state offices, vocational schools, and high schools. Commonwealth universities saw a mission to reach out to improve educational opportunities throughout their states; legislatures saw these networks as ways of reaching and binding together their constituents in vastly dispersed areas.

The first wave of use of videoconferencing in K-12 began in the late 80's/early 90's, and predictably arose for the most pressing reason: access. Commonwealth universities saw a mission to reach out throughout their states to improve educational opportunities; legislatures saw these networks as ways of reaching and binding together their constituents in vastly dispersed areas…The second wave began around 2000 and has already crested.

During this phase, K-12 users were spokes on a wheel, not the wheels themselves. Many urban exceptions existed, but as a rule, videoconferencing for K-12 was considered a rural application used to deliver AP classes, mentoring, or otherwise unavailable courses. And often it was delivered over closed fiber networks that might not be accessible from one county away, much less one state away.

The second wave began around 2000 and has already crested. This wave has consisted of new applications, new players, and new funding sources, as well as new approaches to technology deployment. Wave 2 has involved digitally tearing down walls, literally opening up the classroom to a more interactive, vastly broader world of opportunities. Suddenly content providers began to have an impact, and the idea of taking one's students for a virtual field trip became an operative mode. In parallel, Internet2 began a push to network states together with very high speed bandwidth and to bring bandwidth to schools with its K20 Initiative; the Megaconference out of Ohio State University sparked a free-wheeling discovery of other users;

and the Keystone Conference gave the K-12 community and content providers a single place to come together. Two leading concerns in 2000, connectivity and funding, began to fade away in the midst of the conversion to Internet Protocol (IP) and the delivery of large quantities of e-Rate and RUS Grant dollars. And educators began to communicate better the uses (and abuses) of videoconferencing, helping one another to make this wave extraordinarily successful (and somewhat more "viral") than was Wave 1.

A third, coming wave is described later in this white paper.

Methodology

This report is the culmination of several months of primary and secondary research. Several searchable directories or lists of locations for classroom videoconferencing exist via the World Wide Web, and in a number of instances their work has contributed to this paper.

Wainhouse Research began by compiling lists of schools and districts throughout the U.S. based on several key sources. These include the following:

- The PacBell/AT&T directory (www.kn.pacbell.com/wired/vidconf/vidconf.html)
- The Center for Interactive Learning and Collaboration (CILC) Videoconferencing Site directory (www.cilc.org).
- The K12 U.S. HighSpeed Networks Website created by SBC's Linda Uhrenholt (www.kn.sbc.com/hsn/#cat4).
- The Avon, Ohio School District website directory (www.avon.k12.oh.us/DistanceLearning/usdl.htm#Ohio-).

In addition, we visited every state's Department of Education website and used Google to seek and identify unknown districts/schools in each state that have listed themselves. We drew on Keystone Conference and NECC presentations and spoke to numerous equipment vendors, resellers, and content providers to gain an additional perspective on the evolution of some of the leading states. The Internet2 K20 Initiative Connectivity Survey (k20.internet2.edu/survey/survey_index.php) was invaluable in rationalizing the numbers and how we factored for those classrooms/systems we could not find to count. Finally, we called and emailed more than 40 knowledgeable end user organizations, content providers, vendors, resellers, and statewide network providers as a "reality check" once the final figures were being tallied.

To varying degrees, each state may have its final totals increased by certain percentages based on our own sense of which states are especially active in the K-12 videoconferencing community. In other words, depending on the state, the numbers are based on the assumption that we could not find every school or district with videoconferencing; as mentioned above, additional classrooms are factored into the final totals.

In compiling and analyzing this data, we make several assumptions to offset the inability to certify that directory listings or "sold systems" are for classrooms, auditoriums, or administrative offices. Except for instances where we know that districts contain certain quantities of video-enabled schools and classrooms, we associate one "classroom" with any individual school. Any undercounting on this score is likely to be offset by the fact that some classrooms contain multiple "systems" in what are called "full mesh" configurations – and the fact that we factored for missed classrooms. Similarly, many schools utilize videoconferencing-enabled carts or set-top systems that can be moved easily from classroom to classroom, or place their systems not in classrooms but instead in administrative offices, perhaps made available to adjacent or nearby

elementary, middle, or high schools. Thus, in an imperfect universe of counting, the one-to-one method may be the most reliable for estimating the adoption of videoconferencing in K-12.

How to Interpret this Data

State data are reported in ranges rather than specific numbers, reflecting our belief that the value in this data is based on how it demonstrates the *relativity* of each state to one another, and not in showing specific quantities of videoconferencing-enabled classrooms. Furthermore, because of the complexity of the topic and the variable reliability of some of the sources, the data should be interpreted with some caution. We may have determined that a particular state has 240 video-enabled classrooms when in fact it has 275. These are estimates based on sound reasoning, but they are estimates. Nonetheless, one content provider supplied a list of its most frequent educational customers by state and the list virtually matched our own relative rankings of top states.

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This is not a contest. But there are clear winners and losers. The winners are those states and networks where learners and educators have embraced the value of interactive videoconferencing in tearing down the walls of the classroom and enriching the educational experience. The losers are those states where opportunities for enhancing the classroom experience and constructivist teaching objectives lay dormant.

State of the States

National Aggregate Data

Wainhouse Research believes that close to 23,000 public, primary and secondary school classrooms or administrative offices have been equipped with videoconferencing as of early 2006. Correlating this number to the 92,000 plus public schools in the U.S. suggests that about 25% of US schools have adopted videoconferencing.

Typical estimates for the average number of U.S. classrooms per school range from 25 to 32. Accepting the lower number would suggest that approximately 2.3M classrooms exist in the U.S. (25 x 92,000). This means that videoconferencing, in terms of the aggregate number of classrooms in the U.S., has achieved about a 1% penetration rate.

State Rankings by Numbers of Classrooms

Table 1 estimates the numbers of classrooms/systems associated with each state and Figure 1 provides a graphical representation of those numbers. California, Texas, New York, Oklahoma, and Ohio have led the way, followed closely by Florida, Indiana, Wisconsin, Missouri, and Pennsylvania. An additional 13 states have between 250 and 500 classrooms; another 17 states have between 100 and 250 classrooms. A total of 11 states have fewer than 99 video-enabled classrooms.

State	# of schools[1]	VC-enabled classrooms	State	# of schools	VC-enabled classrooms
California	8914	1000 - 3000	Utah	791	100 - 250
Texas	7646	1000 - 3000	Hawaii	279	100 - 250
New York	4400	1000 - 3000	New Mexico	792	100 - 250
Oklahoma	1814	1000 - 3000	Mississippi	886	100 - 250
Ohio	3826	1000 - 3000	North Dakota	529	100 - 250
Florida	3314	500 - 1000	South Carolina	1053	100 - 250
Indiana	1891	500 - 1000	Idaho	654	100 - 250
Wisconsin	1988	500 - 1000	Oregon	1273	100 - 250
Missouri	2274	500 - 1000	Illinois	4292	100 - 250
Pennsylvania	3185	500 - 1000	Tennessee	1610	100 - 250
New Jersey	2410	250 - 500	New Hampshire	472	100 - 250
Kansas	1423	250 - 500	North Carolina	2223	100 - 250
Minnesota	2119	250 - 500	Wyoming	383	100 - 250
Iowa	1519	250 - 500	Colorado	1630	100 - 250
Washington	2170	250 - 500	Maine	681	100 - 250
Maryland	1340	250 - 500	Nevada	517	1 - 99
Nebraska	1280	250 - 500	Montana	870	1 - 99
Alaska	506	250 - 500	Louisiana	1509	1 - 99
Alabama	1381	250 - 500	Massachusetts	1889	1 - 99
Kentucky	1387	250 - 500	Rhode Island	326	1 - 99
South Dakota	749	250 - 500	District of Columbia	193	1 - 99
Arkansas	1129	250 - 500	Connecticut	1073	1 - 99
Michigan	3782	250 - 500	West Virginia	784	1 - 99
Georgia	1969	100 - 250	Arizona	1742	1 - 99
Virginia	1839	100 - 250	Vermont	359	1 - 99
			Delaware	197	1 - 99

Table 1 U.S. States Ranked by Numbers of Schools with Videoconferencing

Higher numbers of videoconferencing-enabled classrooms in any state can be important for achieving the critical mass necessary to support local content providers and training initiatives, as well as for fostering new, interesting applications and interactions between schools. For a variety of reasons, mostly having to do with factors like economic clout, grant-writing abilities, and a legacy of investing in statewide infrastructure, states like Texas, New York, Oklahoma, and Ohio (with an ATM backbone) are leading the second wave of videoconferencing in K-12. Other states have aggressive statewide infrastructure initiatives or Internet2/university leadership, such as California (CENIC), Florida (virtual schools), and Indiana (IHETS). Some of those in the "third-tier" of states (250 – 500), e.g., Kansas, Minnesota, Iowa, and Nebraska were built with one or more "closed" fiber networks but have begun to open up through gateways in recent years to other networks.

[1] Overview of Public Elementary and Secondary Schools and Districts, National Center for Educational Statistics, 2002. http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2003411

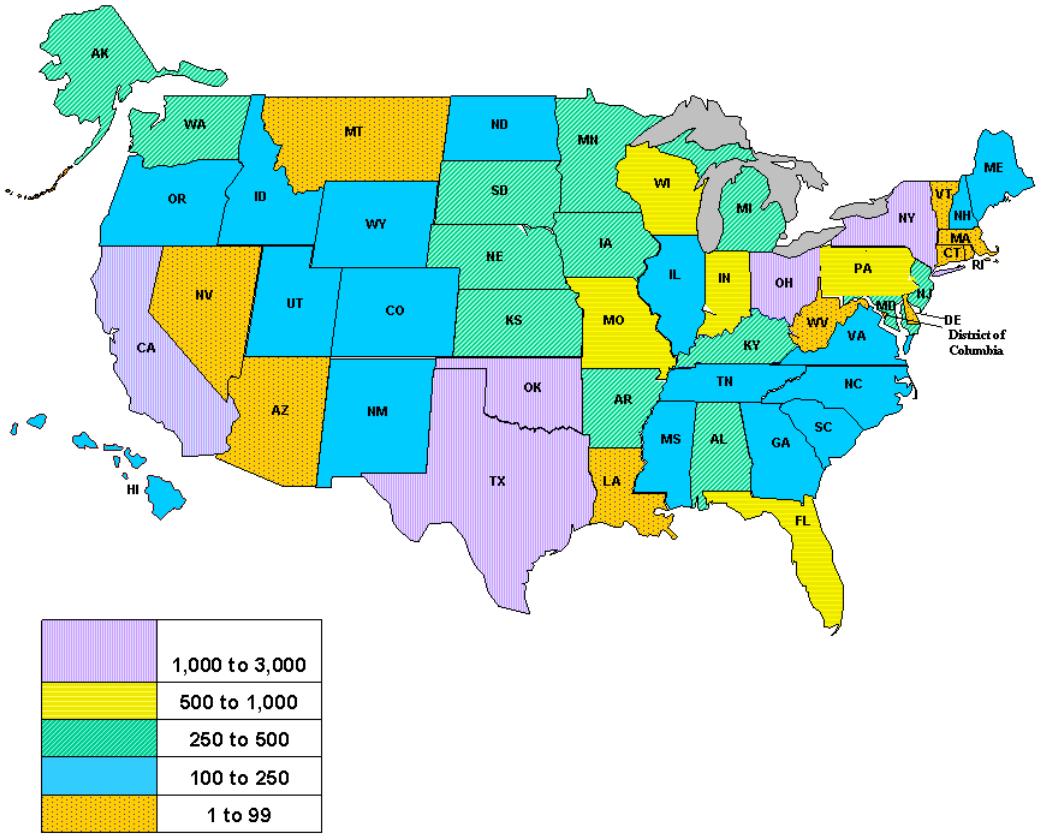

Figure 1 U.S. Mapped by Numbers of Schools with Videoconferencing

Some states are laggards as a result of several factors: lack of statewide infrastructure initiatives, lack of an outreach sensibility, and perhaps competing sub-networks that never found a particularly compelling reason to cooperate and grow or exchange applications. While not universal, a degree of proportionality exists between number of schools and numbers of video-enabled schools in each state. Put simply, states with more schools tend to have higher numbers of enabled classrooms (with Alaska and South Dakota as exceptions – they have fewer schools while still ranking high in penetration). Similarly, states with fewer schools tend to have fewer video-enabled classrooms (with Arizona, Connecticut, Massachusetts, and Louisiana as exceptions – again, these states have high numbers of schools but low adoption rates).

Degree of Adoption State by State as Percentage of Total Schools

The story is somewhat different when we examine the numbers of video-enabled classrooms as a percentage of total number of schools per state, as shown in Table 2 and Figure 2. As might make sense, the two most geographically isolated states in the nation, Hawaii and Alaska, have the greatest penetration of videoconferencing in the classroom. Other top-ranking states include the densely populated leaders (Texas, New York, Ohio, Indiana, and California) as well as the highly geographically dispersed (Oklahoma, South Dakota, North Dakota, Kansas, Wyoming, and Wisconsin, among others).

State	# Public Schools*	Statewide penetration	State	# Public Schools*	Statewide penetration
Hawaii	279	80% - 100%	Florida	3314	20% - 40%
Alaska	506	60% - 80%	Missouri	2274	20% - 40%
Oklahoma	1814	40% - 60%	Mississippi	886	20% - 40%
New York	4400	40% - 60%	Minnesota	2119	20% - 40%
South Dakota	749	40% - 60%	New Jersey	2410	20% - 40%
Ohio	3826	20% - 40%	Nevada	517	1% - 20%
Indiana	1891	20% - 40%	Washington	2170	1% - 20%
Texas	7646	20% - 40%	South Carolina	1053	1% - 20%
North Dakota	529	20% - 40%	Maine	681	1% - 20%
Kansas	1423	20% - 40%	Pennsylvania	3185	1% - 20%
Wyoming	383	20% - 40%	Oregon	1273	1% - 20%
California	8914	20% - 40%	Virginia	1839	1% - 20%
Wisconsin	1988	20% - 40%	Georgia	1969	1% - 20%
Utah	791	20% - 40%	Montana	870	1% - 20%
Arkansas	1129	20% - 40%	Tennessee	1610	1% - 20%
New Hampshire	472	20% - 40%	Michigan	3782	1% - 20%
Iowa	1519	20% - 40%	Colorado	1630	1% - 20%
Nebraska	1280	20% - 40%	North Carolina	2223	1% - 20%
Maryland	1340	20% - 40%	Louisiana	1509	1% - 20%
District of Columbia	193	20% - 40%	West Virginia	784	1% - 20%
Idaho	654	20% - 40%	Vermont	359	1% - 20%
New Mexico	792	20% - 40%	Connecticut	1073	1% - 20%
Alabama	1381	20% - 40%	Massachusetts	1889	1% - 20%
Kentucky	1387	20% - 40%	Illinois	4292	1% - 20%
Rhode Island	326	20% - 40%	Delaware	197	1% - 20%
			Arizona	1742	1% - 20%

Table 2 U.S. States Ranked by Percentage Penetration of Classrooms

The list of states by percentage of penetration may be somewhat puzzling at first glance. The size of a state in terms of quantity of schools seems to have no bearing on its degree of penetration, with NY, Ohio, and Texas in the top 10 by penetration but Illinois, Massachusetts, North Carolina, and Michigan all with low penetration rates. Certain states that have fewer schools are also less penetrated. South Dakota, Kansas, Wyoming, Utah, and Arkansas, however, have fewer schools than many other states but very high penetration.

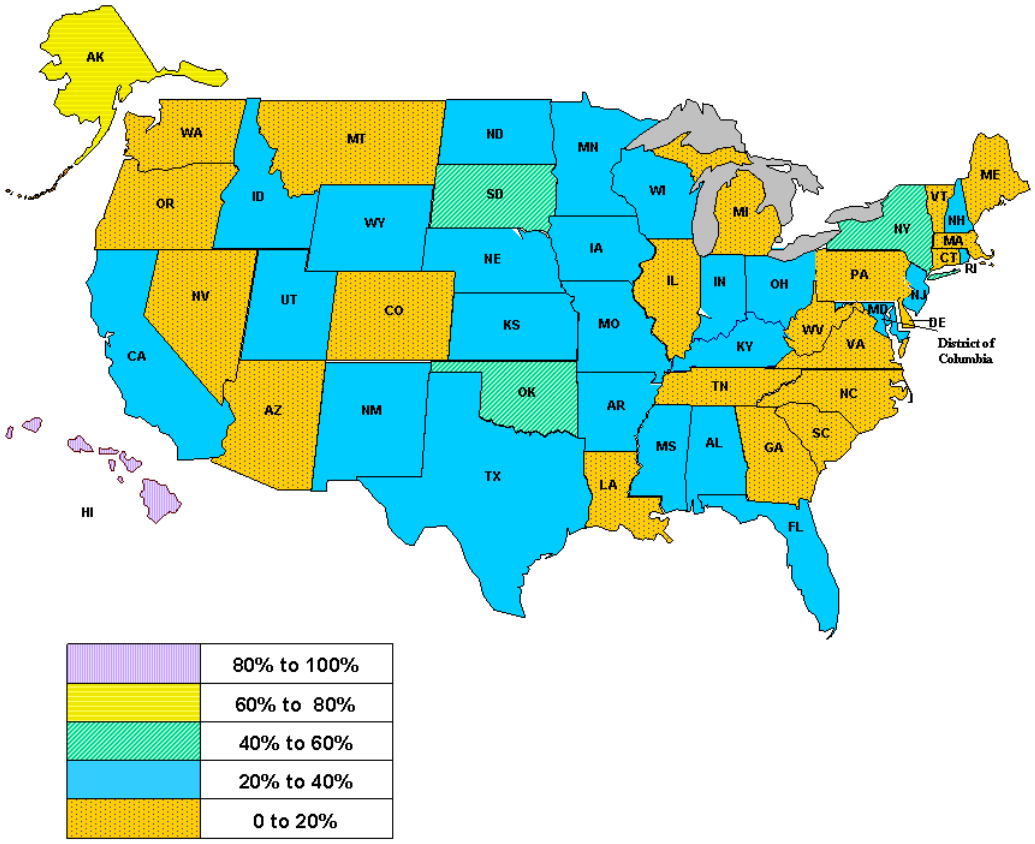

Figure 2 States Mapped by Percentage Penetration of Classrooms

What the highly penetrated states have in common is that to varying degrees they:

- Frequently are big and highly rural (Alaska, Oklahoma, New York, South Dakota, Ohio, Texas) or challenged by geography (Hawaii, Alaska)
- Have active legislatures that fund network infrastructure or otherwise make bandwidth available
- Have leadership that extends from what might be called K-12 or higher education "node" or "seed" networks
- Have some type of champion leading the charge or talented grant writers.

The underlying factors for the less penetrated states are less easily discernible. Arizona, North Carolina, West Virginia, and Louisiana are highly rural. Delaware, Vermont, and West Virginia are small, and West Virginia is as challenged by its geography as many of its larger sister states. We theorize that in the states with larger urban areas or in the small states, there is less of a sense of isolation or need to connect to other schools and resources. Another hypothesis is that in some of these states, the focus has been on higher education or telemedicine (university-to-university, university-hospital-to-clinic) videoconferencing initiatives instead of outreach to K-12 schools and communities. Finally, some of these states may have had seed projects in which certain school districts or networks adopted videoconferencing, but because of the complexities of deploying and paying for the technology or other factors, the equipment is under-utilized or

neglected as a tool. In short, without an effective business model or reason for organic growth, networks by nature remain stagnant.

Internet2 SEGP Correlation

As of early 2006, 35 of 50 U.S. states are Internet2 Sponsored Educational Group Participant (SEGP) states, whereby sponsoring institutions make available to K-12 and other entities access to Internet2 resources. One theory explaining why videoconferencing has not been adopted in some states is that those states are not yet SEGP states. This is not borne out by the data. As Table 3 demonstrates, some highly penetrated states are not SEGP states, and some less penetrated states are in fact SEGP states. The Internet2 SEGP program is providing a tremendous resource for videoconferencing and promotes videoconferencing as the "killer app" with its K20 initiative. Reportedly some 44% of SEGP-connected schools (in the aggregate) have videoconferencing. Yet no clear cause-and-effect picture of its impact is apparent at this time.

Table 3 highlights each state's SEGP status and collates survey data from the K20 Initiative Connectivity Survey, an online survey completed to assess use of Internet2 resources on a state-by-state basis. The total number of SEGP-connected schools is a subset (in most states) of all schools. The percent of SEGP-connected schools with videoconferencing consists of the percentage of that subset with videoconferencing. While this data was used to contribute to some of the rationale behind the final tallies, some discrepancies do exist between the survey's findings and our own findings. In fact, we believe the survey overstates penetration in a handful of states e.g., Rhode Island and South Carolina. We believe Hawaii is more penetrated than is indicated by the Internet2 survey; this may be the result of sampling errors or individuals responding to their survey who perhaps lacked knowledge of deployed classrooms.

The point of the table is to suggest that much more can be done within states that are part of the SEGP program to promote videoconferencing in the classroom. States are listed in the same order as in Table 2 – ranked by the percentage of videoconferencing-enabled classrooms.

SEGP State[2]	State	Total SEGP-connected schools	% SEGP-connected schools with VC
√	Hawaii	300	20%
√	Alaska	260	100%
√	Oklahoma	549	80%
√	New York	74	100%
	South Dakota		
√	Ohio	3973	80%
√	Indiana	476	35%
√	Texas	816	15%
√	North Dakota	567	30%
√	Kansas		
	Wyoming		
√	California	7039	25%
√	Wisconsin	1988	75%
√	Utah	800	50%
	Arkansas		
	New Hampshire		

[2] Internet2 K20 Initiative Connectivity Survey, http://k20.internet2.edu/survey/survey_index.php

SEGP State[2]	State	Total SEGP-connected schools	% SEGP-connected schools with VC
√	Iowa	400	30%
√	Nebraska	220	100%
√	Maryland	1250	30%
	District of Columbia		
	Idaho		
√	New Mexico	2	0%
√	Alabama	1200	0%
√	Kentucky	1400	30%
√	Rhode Island	408	90%
√	Florida	NA	NA
√	Missouri	1759	20%
	Mississippi		
√	Minnesota	671	60%
√	New Jersey	432	100%
	Nevada		
√	Washington	2078	15%
√	South Carolina	1151	50%
√	Maine	NA	NA
√	Pennsylvania	600	72%
√	Oregon	759	0%
√	Virginia	1	100%
√	Georgia	NA	NA
	Montana		
	Tennessee		
√	Michigan	151	75%
	Colorado		
√	North Carolina	600	5%
√	Louisiana	NA	NA
	West Virginia		
	Vermont		
√	Connecticut	1200	40%
√	Massachusetts	350	10%
√	Illinois	4077	5%
	Delaware		
	Arizona		

Table 3: Percentage of Penetration in SEGP-connected schools

Economic and Other Drivers

As stated earlier, a number of complex drivers intersect to help drive videoconferencing adoption in the classroom: geographies that "beg" for outreach, statewide or regional bandwidth initiatives, grant writers, and even champions. Two factors are likely to have an impact on the direction of videoconferencing as a K-12 enrichment tool. These are a) funding, and b) evolving content. Key funding initiatives and larger economic issues are reviewed below before turning our attention to the evolution applications and content.

In addition to individual state or regional bond initiatives, the major national funding sources in recent years for K-12 videoconferencing have been U.S. e-rate grants and Rural Development Telecommunications Program (RUS Distance Learning and Telemedicine) grants. Both of these programs pay for equipment but not for network or other services. The total RUS grant funds have been reduced from $692 million in fiscal year 2004 to $272 million in fiscal year 2006, a roughly 60% reduction over a two-year period, and about $30 million of that will go towards videoconferencing. Based on changes in the program, these grants are now likely to be more frequently awarded, but in smaller amounts than were awarded in the past (when they could total up to $500,000).

The e-rate program remains the single largest source of funding at the national level, awarding more than $3.5 billion in 2005 for a variety of technologies (no statistics are available on how much of this was for videoconferencing, but in 2006 the e-rate program began to track and report this data). Other grants can be received for items like professional development. Most of the major vendors of videoconferencing have support staff to assist schools in applying for all types of grants.

Funding obviously is an important issue in driving adoption, but for the foreseeable future we believe it will continue to be "accomplished" as it has been in recent years: through a combination of federal grants and local or statewide initiatives. Some newer economic issues, such as No Child Left Behind mandates that affect larger funding issues, as well as increases in the price of gasoline suggest that funding will remain a complex and challenging, but surmountable issue.

Economists have theorized that gas prices are beginning to have an impact on inflation and spending patterns; they certainly have impacted school districts across the country in 2005-2006. Wainhouse Research believes that should gas prices remain in the $3.00 per gallon range, an increasing number of school districts will begin to seek alternatives to traditional local field trips and itinerant teacher solutions. And this will set the stage for return on investment justifications that go beyond other traditional arguments for videoconferencing in the classroom.

Wainhouse Research believes three major factors are leading to the coming third wave for videoconferencing in the classroom: a coming evolution of applications, the explosion of content providers, and the bandwidth initiatives already discussed in this white paper. Wave 3 will consist of greater collaboration student-to-student and greater content creation in the classroom.

Gas prices alone, however, will not be a panacea that will lead to rapid adoption. Wainhouse Research believes three major factors are leading to the coming third wave for videoconferencing in the classroom: an evolution of applications, a steady increase in numbers of content providers, and the bandwidth initiatives already discussed in this white paper.

The Coming Third Wave for Videoconferencing in the Classroom

Just as the drivers for videoconferencing in the classroom have evolved from statewide outreach to grant availability and increased content, the applications have evolved as well. What began as a simple extension to distance education through class delivery, mentoring, and the like in Wave 1, and evolved in Wave 2 to include access to content providers, is about to undergo its next phase of development. Wave 3 will consist of increased student-to-student collaborative projects and even student creation and delivery of content. Connecting groups of students to participate in real-world, real-time learning engagements is a very powerful use of this technology and educators are just beginning to explore this application.

This is not to suggest that Waves 1 and 2 will go away. Each of these waves will co-exist and support one another (that is, content providers and distance education classes will continue to increase in numbers and offerings).

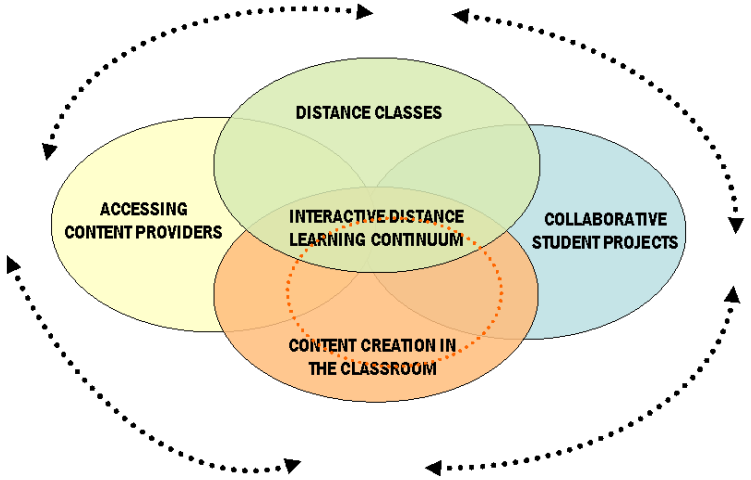

Figure 3 Evolution -- Wave 3 of Videoconferencing in K-12 [3]

But with the continued proliferation of classroom endpoints, the adoption of adjacent technologies (web conferencing, groupware, and low-end, PC-based videoconferencing e.g. Apple iChat, Skype video, and the like), and continued enthusiasm on the part of the educational champions of video in the classroom, the next wave could prove to be the "tipping point" for videoconferencing in K-12.

[3] Source: Jan Zanetis, TANDBERG

Conclusions

It will require much "tipping" to shift from 1% penetration of classrooms to anything resembling mass adoption. The longer-term prospect is that videoconferencing will become as ubiquitous as blackboards and computers. In the shorter term a few barriers need to be removed, and a number of states will continue to lag behind others, for lack of resources, champions or vision, or simply because of attention placed elsewhere. Challenges remain as a result of attitudes that developed when legacy systems were improperly deployed without sufficient training or ongoing resources. Perhaps the biggest challenge is the individual educator who may be neither attuned nor open to the concept of going outside the classroom walls to support constructivist learning models. A certain amount of openness to the uncontrollable, unpredictable nature of technology and human interactions across distance is a prerequisite for excitement about videoconferencing in the classroom. Yet videoconferencing has become easier to use in recent years, quality and reliability have improved, access to other school networks and content providers via firewall solutions and gateways have arrived, and the overall experience is more seamless and comfortable for both students and educators. Vendors also have initiated new, rich training and content programs that are further supporting their educational users.

More can be done within states that are part of the Internet2 SEGP program to promote videoconferencing in the classroom. Yet the wave of bandwidth and funding initiatives in many heavy-hitting states and the nexus of classroom-content providers in existence today are likely to lead to steady and continued growth in the U.S. classroom for this technology. While current leaders will likely continue to set the pace, less geographically isolated districts that have previously not emphasized videoconferencing technologies may be increasingly motivated by economics and newer content and applications to implement new programs (or dust off unused equipment). Technology funding initiatives and increasingly compelling content may motivate legislators and school boards in lagging states to review their implementation strategies. Schools that wish to capitalize on Wave 3 applications should first review existing and evolving applications in relation to educational goals and then examine whether or not they have underutilized resources (Internet2 bandwidth, champions/grant writers, and relationships with content providers). The relatively high adoption rates in diverse states suggests that there are compelling educational benefits and business models for states with high and low populations, whether concentrated or dispersed.

Ultimately, the promise of student-driven, collaborative, problem-solving activities will begin to mirror and perhaps even surpass the use of video in the global workplace. How educators will get there will be interesting to watch, as the blend of technologies, resources, and learner-oriented objectives continue to evolve over time.

About the Author

Alan D. Greenberg is Senior Analyst & Partner at Wainhouse Research. As consultant, analyst, and strategist, Alan has worked in the telecommunications, videoconferencing, software and services, and multimedia arenas for 20 years, holding positions with VTEL, Texas Instruments, and several Austin, Texas-based startups, and consulting to many organizations. He has conducted research into dozens of distance learning networks, was product marketing manager for a set of turnkey classroom packages, and led a number of educational and training initiatives, including serving on the Keystone Conference Steering Committee. Most recently he co-authored the segment report, *Personal Mobile Video Communications at the Launchpad*, and authored the white papers *Best Practices in Live Content Acquisition for Distance Learning Networks*, *Navigating the Sea of Research into Videoconferencing-Based Distance Education*, and *Super-Size Bandwidth and Two-Way Video in the Classroom*. He also has authored reports on conferencing endpoints & bridges, streaming video, web conferencing, and voice/fax services. Alan holds an M.A. from the University of Texas at Austin and a B.A. from Hampshire College. He can be reached at agreenberg@wainhouse.com.

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Wainhouse Research (www.wainhouse.com) is an independent market research firm that focuses on critical issues in rich media communications, videoconferencing, teleconferencing, and streaming media. The company conducts multi-client and custom research studies, consults with end users on key implementation issues, publishes white papers and market statistics, and delivers public and private seminars as well as speaker presentations at industry group meetings. Wainhouse Research publishes Conferencing Markets & Strategies, a three-volume study that details the current market trends and major vendor strategies in the multimedia networking infrastructure, endpoints, and services markets, as well as a variety of segment reports, the free newsletter, The Wainhouse Research Bulletin, and the PLATINUM (www.wrplatinum.com) content website.

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