
One-to-One Computing in Virginia
A STATE PROFILE

PRELIMINARY REPORT
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Executive Summary

The Commonwealth of Virginia is a strong local control state. As a result, Virginia's state policy often follows the innovative policies playing out in its school divisions. For example, the lofty goal of a five-to-one student to computer ratio was originally established in the 1996-2002 *Six Year Plan for Educational Technology*, under the advisement of the Virginia Educational Technology Advisory Committee (VETAC). As in most states, the plan did not mandate such ratios, but the Virginia legislature did (and continues to) offer substantial state funding for building toward such an installed base of computers and the networking infrastructure for robust connectivity. Still, in the end, final decisions are up to the local school divisions.

Ubiquitous Computing in Virginia

Implementation in Pioneering School Divisions:

- *Henry County Public Schools: "Universal Laptop Access Project" 1998*
- *Henrico County Public Schools: "Technology and Learning Initiative" 2001*

Students and Teachers Currently Involved: 37,000

Number of Schools: 45 schools in 2 districts

Technology Currently Used: Apple iBooks, Gateway laptops, wireless networking

During that same period of time, the Virginia legislature, in support of Standards of Learning in mathematics and science, enacted a pioneering initiative that required—and funded—scientific calculators for all Virginia middle and high school students studying those subjects. In essence, this established ubiquitous technology use for high school students, and was a state action based on strong input from school districts.

A 2000 initiative by the Virginia Department of Education (VDOE) launched online, Web-based Standards of Learning (SOL) instruction, remediation, and examinations in all Virginia high schools. The Commonwealth, despite the current economic challenges it faces, continues to fund this SOL Initiative, which has been expanded to the state's public elementary and middle schools as well. And it's meeting with a significant measure of success, too: as of spring 2004, the Commonwealth's high schools were voluntarily conducting approximately 50% of their SOL testing online. That translates into nearly 400,000 tests administered online in the 2003-2004 school year.

To ensure that schools have the computers, infrastructure, and secure network to advance online testing, the state invests roughly \$60 million annually in the SOL program. But while online testing that requires a five-to-one ratio of students to computers has been mandated and funded at the high school level, at other levels the Commonwealth continues to leave the issue of student-to-computer ratio up to individual school divisions. In the end, however, this policy will likely establish the robust technological infrastructure necessary for schools and districts to move closer to ubiquitous computing, albeit at their own pace.

Expected Return on One-to-One Investment by Pioneering School Divisions:

- Improving academic achievement (SOL scores)
- Preparing 21st century students for the real world/economically viable communities
- Improving teaching and learning
- Closing the digital divide

In 2003, in part due to the national spotlight on Henrico County Public Schools, as well as to the pioneering ubiquitous computing efforts of Henry County Schools, the Commonwealth commissioned a legislative report by the Joint Legislative Audit and Review Commission (JLARC) that included funding scenarios ranging from the five-to-one ratio outlined in the 1996-2002 state plan to a visionary one-to-one computer ratio for all public schools across the state. While this report, titled *State Funding Formula for Educational Technology*, outlined statewide ubiquitous computing as an option, that aspect was not seriously considered by state legislators due in part to severe budget shortfalls in the Commonwealth. As a result, five-to-one is still the gold standard toward which many districts are striving, and which the state on average, is now exceeding. This is due to the fact that the state is supporting school divisions building of their technological infrastructure through annual funding for the Web-Based Standards of Learning Initiative. Additional funding is also under serious consideration by the 2004 General Assembly for technology upgrades and support for technical and integration staff as a result of the JLARC report.

Furthermore, the 2003-09 *State Technology Plan for Virginia* established a connectivity goal to ensure that “*all public schools have access to integrated instructional and administrative services across interoperable high-speed networks*” (see: <http://www.pen.k12.va.us/VDOE/Technology/>). While progress measures for that goal focus on the five-to-one ratio, the collaborative strategies for all school divisions are to:

- Establish a 5:1 ratio of multimedia, networked computers to students
- Establish a ratio of computers to students of 1:1 in grades 3-12, and 1:3 in Grades 1-2.

This suggests that a three-to-one ratio of students-to-computers, then a one-to-one ratio, are the next logical steps for the Commonwealth to advance learning, teaching, and testing through the use of technology.

It should be noted, however, that state leaders in Virginia also recognize that one size does not fit all districts. In fact, the history of ubiquitous calculator use in the Commonwealth may influence the acceptance of ubiquitous computing. While the calculator rollout in 1996 was looked on with favor at the time, school divisions have since been left to their own devices to pay for the operation, maintenance, and upgrading of this equipment. As a result, Virginia school divisions have experienced first-hand the difficulty of finding funds to sustain, upgrade, and replace a technology once made easily available to all students through state funds.

Nevertheless, the Commonwealth’s most pioneering school divisions are independently forging ahead with the paradigm shift of ubiquitous computing. The bottom line is that a specific, statewide initiative on ubiquitous computing, which would divert funding away from the current well designed, well funded strategic direction, will probably not happen in Virginia. Instead, the Commonwealth appears to be slowly and steadily moving toward selective ubiquitous computing driven by the Standards of Learning, since the key to sustained funding in Virginia is the legislative tie between technological infrastructure and the SOLs. State leaders will continue to build a robust infrastructure and lower the ratio of students-to-computers year-by-year, in effect moving toward increased access for students without directly mandating such access. Essentially, the innovative efforts of Virginia’s current one-to-one school divisions are what have prompted the state to study and consider ubiquitous computing, while state money has funded the robust infrastructure that provides a technological backbone to those school divisions pursuing one-to-one.

Background on State Technology Policy:

The Commonwealth of Virginia has consistently demonstrated a commitment to educational technology, as evidenced by the following state policies adopted both legislatively and administratively:

The Virginia Standards of Quality (SOQ) require local school boards to implement a program of instruction that emphasizes “*proficiency in the use of computers and related technology.*”

- According to Section 22.1-199 of the Code of Virginia, “*educational technology is one of the most important components...in ensuring the delivery of quality public school education throughout the Commonwealth.*”
- The Virginia Standards of Learning (SOL) contain specific computer/technology standards for grades five, eight, and twelve.

In addition, the fall 2003 JLARC report presented the funding challenges and options related to school technology. The report identified the top two technology issues facing Virginia school divisions as staffing and equipment replacement, and further included legislative consideration of ubiquitous computing. In a section of the report titled, “*Illustrative Funding Formula Combinations,*” JLARC laid out the following five scenarios for funding hardware in Virginia schools:

Summary of Funding Formula Options for Hardware Replacement:	Projected Cost (in 2002 dollars)
1. <i>Prevailing Cost Option</i> – Based on the typical hardware replacement expenditures made by school divisions	\$48.61 million
2. <i>5 to 1 Student-to-computer Ratio</i> with 5-Year Replacement Cycle	\$63.75 million
3. <i>5 to 1 Student-to-computer Ratio plus Administrative Computers</i> with 5-Year Replacement Cycle	\$64.1 million
4. <i>3 to 1 Student-to-computer Ratio</i> with 5-Year Replacement Cycle	\$103.02 million
5. <i>1 to 1 Student-to-computer Ratio</i> with 5-Year Replacement Cycle	\$299.33 million

Source: Sarte, K. (September 8, 2003). *Staff Briefing - Joint Legislative Audit and Review Commission of the Virginia General Assembly*. pp. 27-8.

While Virginia legislators, due to severe budget short falls in the Commonwealth in the last few years, are not currently considering increased funding for any of the options listed above, it is important to note that the leadership in local schools put those options on the table at the state level.

Select 1-to-1 School Divisions in Virginia

Henrico County Public Schools:

Over the course of two years, Henrico County Public Schools (HCPS) provisioned its 28,000 secondary school students (and their teachers) with laptop computers, largely due to the vision of the district's former Superintendent, Mark Edwards. The scope of the one-to-one program in Henrico is unmatched to date, even by many statewide initiatives, and the district continues to serve as a model for those considering ubiquitous computing initiatives of their own.

"Now we reach students we never could have before, in ways we could not have by using just a chalkboard."

-- High School Teacher, Henrico County Public Schools

In 2001, thousands of high school students in Henrico County, Virginia received laptop computers as part of the district's Technology and Learning Initiative. A few months later, in January of 2002, middle school teachers in the county were issued their own machines, and by fall of that same year their student had begun training on them using mobile carts. By the spring of 2003, more than 28,000 teachers and students in grades 6 through 12 had been given laptop computers (Apple iBooks) for use 24 hours a day, 7 days a week. The county further negotiated a low monthly rate for home Internet access: under \$10 per month if paid for a full year. Parents are responsible for a \$50 annual insurance fee, which is reduced for students from lower income families.

1-to-1: Unanticipated Results:

- Teacher enthusiasm, retention, and recruitment
- Parental involvement in school and increased technology literacy

There are 66 schools in Henrico County Public Schools, or HCPS, all of which vary in size (from 800 to 1,700 students), student demographics, and geographic location. Eight of the district's schools are high schools, and 11 are middle schools. According to Henrico's Superintendent, approximately 25% of the 43,000 enrolled students are eligible for free or reduced price lunch, yet the district annually spends close to \$500 per pupil less than other districts in the state. To support the laptop program, the district has dedicated between 4 and 5% of its operating

budget over 10 years.

Henry County Public Schools:

In rural Henry County (student population about 8,800), the Board of Supervisors and the School Board began to collaborate in 1998 on a cutting-edge project to place laptops in the hands of all 4th-12th grade students. In addition to regular school budget funding (and through the acquisition of low-interest loans), the supervisors committed \$1.6 million dollars over a three-year period to jumpstart one-to-one, initially providing the school system with funding for laptops for all 4th and 8th grade students. A year later, they expanded the program to include 5th and 9th grades, spending an additional \$1.5 million. Computers initially went home 24x7, and the district charged a small monthly "rental fee" to encourage a sense of ownership among students (this fee was reduced for students qualifying for free or reduced lunch).

The original plan in Henry County was to expand the 24x7 one-to-one program through grade 12. Unfortunately, district budgets tightened, so they used grant monies to buy several classroom sets of laptops for each of the district's 21 schools instead. Though this translates into a

1-to-1: Remaining Challenges:

- Durability of hardware/ frequency of repairs
- Time (for teachers and administrators)

somewhat higher student-to-computer ratio, it does allow periodic ubiquitous computing experiences for every student in the district. Teachers now regularly schedule and check out laptop carts for appropriate lessons (K-8 schools have carts of Apple iBooks with AirPort wireless and 9-12 schools have wireless Gateway laptops; platforms were selected based on the availability of applications targeted to grade-level needs).

Finally, students are provided with network accounts through the district, which they are encouraged to access from home if they have their own technology (65% of students already had computers at home when the program was implemented) or if they've checked out a laptop for home use. Parents are also trained – by students – to use the laptops, and the technology is available to the community in the evenings. The district has even set up a “parent resource center” at their local mall.

Many stakeholders in Henry County, both within the educational community and outside of it, have expressed feelings that one-to-one not only brings a vast new set of skills to parents and students, but that it creates a new image for the community and a new pride in its citizens. In Henry County, as is the case elsewhere, there is the sense that the intangible results of one-to-one are just as important as the more tangible ones.

1. Why did (or didn't) educational policymakers in Virginia focus on ubiquitous computing?

“Virginia’s leaders have prepared the state to be attractive to companies and investors by providing the technology infrastructure and skilled workforce today’s businesses require. Critical to the state’s ability to capitalize on this advantage is the extent to which Virginia’s schools prepare the next-generation workforce for knowledge-based jobs that utilize cutting-edge information technology.”

-2003-09 State Educational Technology Plan for Virginia

“Virginia is slowly but surely building a robust, sound infrastructure that will one day serve as a sound platform for ubiquitous computing statewide—by the time it is cost effective on a wide scale. In the meantime, we continue to seek legislative funds to incrementally increase the capacity of school divisions to use the access we have wisely, by providing technical support and integration staff through state dollars.”

-Dr. Lan Neugent, Associate Superintendent, Virginia Department of Education

State level policymakers in Virginia identified three key factors that influenced their thinking about one-to-one:

- The pioneering work of Henrico and Henry County school districts in establishing ubiquitous computing initiatives
- The challenge of sustaining the ubiquitous calculator initiative
- The lack of state funds for supporting such initiatives

To date, policymakers have set one-to-one computing as a long-term goal for their school divisions—at least for grades 3-12—but have neither mandated, nor funded, ubiquitous computing. At the same time, Virginia continues to fund technology at approximately \$50 million per year. In targeting those funds to connectivity, it is building the foundation for ubiquitous computing should schools choose that direction.

Vision:

The 2003-09 *Educational Technology Plan for Virginia* advances the vision that, “*all students [should] develop the technology skills and knowledge to realize their potential as leaders in a technology-supported information economy.*”

Advocacy and Justification:

The Virginia General Assembly has not yet seriously considered ubiquitous computing at the state level; assembly members were stopped short by the high costs identified in the JLARC report. While in other states EETT funds have been used for innovative ubiquitous computing initiatives (e.g., Michigan, Texas), Virginia has decided to dedicate all of their EETT funds to professional development. In fact, this was called for in the most recent state technology plan.

The federal No Child Left Behind Act of 2001 emphasizes the need for supporting education practices with evidence-based research. The research base that supports the 2003-2009 *Educational Technology Plan for Virginia* underscores the Commonwealth's commitment to long-range, effective, and statewide integration of educational technology into teaching, learning, and school management. Each of the five sections of the plan (Integration, Professional Development, Connectivity, Educational Applications, and Accountability) includes a comprehensive literature review. The key resources associated with the discussion around ubiquitous computing and student-to-computer ratios include:

Atkinson, R. (2002). *The 2002 state new economy index: Benchmarking economic transformation in the states*. Washington, DC: The Progressive Policy Institute.

Maine Association for Middle Level Education. Online at: <http://www.mamleonline.org/tech.html>.

Milken Exchange, North Central Regional Educational Laboratory, and SRI International (1998). *Report to the Commonwealth of Virginia: An analysis of the status of education technology availability and usage in the public schools of Virginia*. Retrieved May 14, 2002 from <http://www.mff.org/pubs/ME156.pdf>.

Rockman, S. (2000). *A more complex picture: Laptop use and impact in the context of changing home and school access*. San Francisco, CA: Author. Retrieved April 3, 2002 from <http://rockman.com/projects/laptop/>.

U.S. Department of Commerce (2002). *A nation online: How Americans are expanding their use of the Internet*. Washington, DC: Author. Retrieved March 29, 2002 from http://www.ntia.doc.gov/ntiahome/dn/nationonline_020502.htm.

U.S. Department of Education (1996). *Getting America's students ready for the 21st century: Meeting the technology literacy challenge*. Washington, DC: Author. Retrieved October 13, 2000 from <http://www.ed.gov/Technology/Plan/NatTechPlan>.

Web-Based Education Commission (2000). *The power of the Internet for learning: Moving from promise to practice*. Washington, DC: Author. Retrieved March 29, 2002 from <http://www.ed.gov/offices/AC/WBEC/FinalReport/>.

The authors of the 2003-09 state plan remind Virginia educators that, *"More important than simply reaching a ratio goal is providing sufficient access to computing hardware and software needed to reach student achievement goals. Greater power in ever smaller computing devices makes some small, affordable units viable options for achieving or even beating the five-to-one goal."*

Impetus at the School and District Levels:

In Henrico County, the one-to-one initiative grew out of a number of existing needs and demands. Key among them were the following three factors:

- Better return on technology investment (one hour a week in labs did not result in student gains)
- Closing the digital divide
- Developing 21st Century Skills
- Instituting reform in the division's high schools

Prior to beginning one-to-one, the Henrico County School Board had challenged the district to develop a 6-year plan to enhance technology; Henrico had invested considerable funds (approximately \$19 million) into computer labs without experiencing any measurable gains in teaching or learning. At the same time, the digital divide in the diverse district seemed to be growing, and almost half of all HCPS students didn't have access to technology at home. Lastly, professional development in the district had been focused on active, engaged learning, and educators were becoming aware that students needed to develop 21st Century Skills to succeed outside of school. The district began considering one-to-one laptop technology as a tool to promote that skill development.

In Henry County, there were two major drivers of one-to-one:

- The desire to improve test scores and
- Economic viability for the community and the area's students

Part of preparing Henry County students to meet the challenges of the 21st century was the need to improve scores on the state's Standards of Learning, or SOLs. In the first year of the district's laptop program, student participants saw a 20% increase in SOL technology scores. Though these achievement gains are not formally tied to the use of laptops, the district is currently tracking SOL scores to demonstrate the linkage they believe exists.

Traditionally an industrial area where textile and furniture manufacturing jobs employed a large portion of the workforce, Henry County had been experiencing economic instability due to changes in county industries, including movement of operations abroad and increased use of technology in manufacturing. As a result, the need to develop a technologically skilled workforce had become critical. Realizing that the economic lifeline of the community rested upon meeting that challenge, county leaders (government *and* educational) embarked on their one-to-one project with a dual purpose: 1) to train students in the use of technology that could facilitate their learning tasks today and provide them with the skills desired by employers tomorrow, and 2) to provide both a workforce and an environment that would attract new businesses and industries to the area. The project was coupled with a retraining initiative for the county's existing workforce, with the anticipation that the two efforts would meet the labor demands of today while building the 21st century skills needed in the future.

Often, local county governmental boards and school boards find themselves at odds where issues of priorities and finances are concerned. In Henry County, however, the two bodies are working together to support the advancement of education for county citizens and to promote the development of a skilled workforce that will support the economic development of the area. The boards' shared vision for the community and the determination to make the vision a reality have resulted in innovations that have gained national attention.

"We know how important computers are going to be for our future, and we believe that this project will give us an advantage."

– Student, Henry County Public Schools

Research, Policy Studies, and Advocacy Documents Used:

The literature review conducted by the Virginia Educational Technology Advisory Committee (VETAC) as a foundation for the state's 2003-09 technology plan included several references to ubiquitous computing (see above). While conducting research for their own 2003 report, *State*

Funding Formula for Educational Technology, members of the Joint Legislative Audit and Review Commission (JLARC) did not specifically seek out documents on one-to-one computing, but they did conduct site visits to Henrico County schools to gather data on one-to-one computing. Both the 2003-09 *Educational Technology Plan* and the JLARC report present ubiquitous computing in the context of a logical long-term goal in the continuous improvement of education through effective technology use in the Commonwealth.

The JLARC report specifically outlines continued investment by the Commonwealth (through the Literacy Fund) for the *Standards of Learning (SOL) Technology Initiative* as follows: \$50.0 million in FY2000, \$56.9 million in FY2001, \$58.3 million in FY2002, \$58.4 million in FY2003, and \$58.6 million in FY2004. School division funding from these appropriations is restricted to capital investments to build the technological infrastructure in Virginia's public schools. With this level of investment, it seems clear that Virginia will have the infrastructure ready for one-to-one computing, should additional school divisions move in that direction as the new technology plan recommends. Furthermore, in a review of the online testing literature included in the 2003-09 plan, it was noted that a statement of issues at the National Online Assessment Conference included the following cautionary note:

"While many schools have reduced their student-to-computer ratio to approach 5:1, this ratio is inadequate for large-scale testing, which would optimally require a 1:1 ratio. Even schools with a 1:1 ratio could have many computers that may not meet the performance requirements of online assessment instruction and remediation."

In fact, the focus and impetus for this significant and consistent level of technology funding in Virginia has been online testing intended to improve student achievement of the SOLs. Legislators have been willing to invest \$282.2 million in the SOL Technology Initiative during the last five years because they see online testing in the high schools as a concrete, important return on the public's investment.

School and District Levels:

Both the Henrico and Henry County districts are leaders in the area of large scale one-to-one computing. While many schools and districts have learned from Henrico and Henry Counties' experiences, neither Virginia district represented here identified any particular studies or models that they used to promote their initiatives. In fact, both Henry and Henrico Counties seem to have "grown" their programs naturally out of the technology and school improvement endeavors that preceded them.

Arguments Against One-to-One:

Within the state education agency, as noted above, the educational technology focus has been on establishing the infrastructure necessary to support online testing, with the rest of the state plan as a backdrop for ensuring the systemic readiness of districts to support and use this infrastructure. Consequently, there do not exist arguments against one-to-one computing so much as there are simply other priorities currently deemed more important. With the recent release of the JLARC report and its illustrative cases, which included one-to-one computing as a fifth option (see above), ubiquitous computing is on the radar screen of Virginia educators; it's in the future, as part of a natural evolution of an ever decreasing ratio of students-to-computers.

School and District Levels:

School and district interviewees in both Henrico and Henry Counties identified the following three general groups as initially opposed to one-to-one technology access:

- Teachers
- Parents
- Community Stakeholders

Teachers:

As administrators in both districts planned for one-to-one, it was anticipated that one of the major obstacles would be teacher acceptance of such a new and different way of doing things. Placing computers in the hands of all students meant that teachers would have to acquire new skills and modify previous lesson plans and activities. Though many did balk at first, teachers generally seem to be making the transition well. In Henrico County, this is enhanced by the fact that department chairs were provided with additional staff development so they could work with teachers having the most difficulty.

Parents:

Parents in both counties also had questions as plans for the one-to-one initiative were presented to them. In Henry County, these dealt primarily with liability and financial issues, so district personnel worked diligently to establish a system that provided technology benefits to students with minimum liability for parents. When parents were requested to attend training sessions before students were issued their computers, the response was very positive. In Henrico, parents were predominantly concerned about inappropriate use. These fears were addressed as they arose, partly through parent training. It also helped that the district added filters and blocks to student computers and staff have been trained to monitor student use.

“Once the parents got into working with the computers, they didn’t want to stop and go home!”

-- Principal, Henry County Public Schools

Community Stakeholders:

Both districts initially encountered a good deal of resistance to one-to-one from the community, and not all of it has subsided. Most nay-sayers, including members of the local press in Henrico, wanted to spend the money on teacher salaries rather than technology. Others voiced the concern that, *“the kids are going to break them”/“they’ll get stolen.”*

The latter are concerns that must be anticipated, and with planning can, for the most part, be averted, says Henry County’s district technology director. That district successfully used the print and broadcast media to disseminate the project’s intended outcomes and to gain public support for the project. Furthermore, technology is available to the Henry community in the evenings, and

“A certain portion of any population usually has a mindset that the status quo should be maintained. This was true in Henry County, particularly of those who had no exposure to computers or their capabilities. But a lot of people changed their minds once they understood what we were trying to do.”

– Superintendent, Henry County Public Schools

students now serve as trainers for community stakeholders. In fact, the district has set up a “parent resource center” at their local mall.

Conversely, while the national press has generally painted a positive picture of ubiquitous computing in Henrico County, the local press has been more focused on the negative aspects of the initiative, even to the point of printing news that has been less than accurate. In fact, recent articles have included inaccuracies that, even when acknowledged by the paper, are not fully retracted.

Unfortunately, early on in the project there were inappropriate uses of the laptops by some Henrico students, including downloading pornography, uploading music and games during classes, and hacking into closed systems. Despite the fact that the district has acknowledged the problems and has worked hard to rectify them by putting policies and procedures to prevent recurrences in place, the local press has continued its negative slant on the project while failing to print the positive.

While there is tremendous anecdotal information documenting the success of one-to-one computing in Henrico, as well as data showing increased student engagement and achievement, the impact of ubiquitous computing has not yet been formally researched. As a result, the initiative is subject to criticism that cannot to date be refuted with research findings (see Assessment sections, below). But with the research currently underway in Henrico County by independent research organizations like SRI International (whose research is funded by the National Science Foundation), for example, the district may soon be able to provide more extensive information about the results of its investment in laptops.

Barriers to One-to-One in Virginia:

At this juncture, state policy on one-to-one computing would require the diversion of state focus and funding away from its building robust connectivity and access to facilitate online testing—a disruption in strategic direction that does not make sense at this time. The Commonwealth is currently investing approximately \$60 million annually in technology infrastructure through its Web-Based Standards of Learning Initiative, and in fact this infrastructure can be used by school divisions to support various configurations of their computer installations—including ubiquitous computing.

Educators in the Commonwealth have worked hard to establish this sustainable funding stream for technology infrastructure in schools. Instead of disrupting current policy, the Commonwealth is systematically positioning one-to-one computing as an option, and perhaps an ultimate outcome, for Virginia’s school divisions’ progress with educational technology. It does not seem likely that Virginia will enact state policy on one-to-one computing in the near future, yet the infrastructure it is systematically building and supporting may provide just the solid foundation the state’s school divisions need to easily transition to one-to-one as they recognize its potential for meeting student learning needs.

School and District Levels:

School and district-level educators in Henrico and Henry Counties identified the following as challenges to the effective implementation of one-to-one. Though most have been addressed or overcome with experience, a few, such as the funding challenges in Henry County and repair issues in Henrico, are ongoing. Other technical challenges faced by both districts include

establishing an adequate repair/maintenance schedule for the equipment, overcoming wiring problems in older school buildings, and purchasing lockable carts for security and charging (Henry County only). Furthermore, organizational challenges, such as determining appropriate technology for the varying grade levels involved, teacher acceptance and support for the program, and the development of liability statements for parents, and human resource challenges, such as securing adequate tech support personnel, developing strategies for classroom/school management, and developing and implementing training plans for teachers, students, and parents are also ongoing issues in both districts.

2. What trends are emerging in national, state, and local policies that impact ubiquitous computing in Virginia?

National Trends:

State policymakers in Virginia hold a range of views on ubiquitous computing. While the recently released 2003-09 *Educational Technology Plan for Virginia* establishes one-to-one computing as a target for school divisions grades 3-12, the General Assembly has not seriously considered statewide initiatives in ubiquitous computing. That said, the *Web-Based Standards of Learning Initiative*, with its \$60 million annual investment, is systematically improving the technological infrastructure and decreasing student-to-computer ratios in school divisions across the state.

The five national trends that influence Virginia's state level decisions on school technology are listed below. Some of these trends serve as barriers to ubiquitous computing in Virginia. Others may eventually lead to one-to-one, albeit in a circuitous route.

- High-stakes accountability
- Lack of student access to technology
- Budget cuts in education
- Standards-based learning
- Renewed focus on highly-qualified teachers

High-Stakes Accountability:

Virginia is stepping up to its NCLB responsibility, in part through its pioneering work with online testing (see text box). While others have focused on the benefits of effective technology use to teaching and learning, Virginia has focused most recently on the advantages of such robust connectivity for high stakes testing through its Web-Based Standards of Learning Technology Initiative. As mentioned above, this may lead to a lower student-to-computer ratio than the current Virginia goal of 5:1.

Example:

The Commonwealth's support for online testing through the Web-based SOL Technology Initiative is building the infrastructure that ubiquitous computing will require.

Virginia's funding for online testing—which helps determine if students will graduate and if their schools will earn state accreditation—has been remarkably consistent over the past few years. According to Lan Nugent, as reported in Education Week's Technology Counts 2003, "The money has helped most public schools develop proper networks to handle online testing and establish data-collection systems."

In late 2000, Virginia began piloting its online tests in high schools, projecting expansion to 400,000 students by spring of 2004.

According to the Education Week article, however, many students still take their end-of-course high school exams (e.g., in Algebra, biology, earth science, English, world history, U.S. history, geography, and chemistry) on paper. The challenge, therefore, will be in leveraging access to Web-based testing into access for teaching, learning, and leading.

Student Access:

Virginia students' access to technology, as reported above, is steadily increasing. According to the 2003-09 tech plan's Executive Summary, and based on a June 2002 report to the state Senate Finance Committee's Subcommittee on Education, "*With the backing of the Governor and the General Assembly and a commitment of more than \$326 million, Virginia has made enormous advances in infrastructure, hardware, software, teaching and learning resources, professional development, and administrative applications*" (Virginia Department of Education, *Educational Technology Plan for Virginia: 2003-2009*. Online at: <http://www.pen.k12.va.us/VDOE/Technology/>).

Budget Cuts:

Despite the deep budget cuts in Virginia, the Commonwealth continues to fund the infrastructure and support for online testing for school divisions through the Web-Based Standards of Learning Technology Initiative at the level of \$50+ million per year.

Standards:

Standards of Learning are the driver for technology initiatives in Virginia. The very name of the related 2000 legislation represents that focus—Web-Based Standards of Learning Technology Initiative. The state seems stuck at a five-to-one ratio partly because legislators do not see ubiquitous computing as a fiscally viable option, but also because state leaders have not yet bought into the vision that ubiquitous computing will provide a greater return on investment than other configurations.

Qualified Teachers:

The 2003-09 state technology plan includes professional development and support programs as one of the five key strategies for successful implementation of technology in schools. In particular, this plan and the JLARC report focused on the need for building-based instructional technologists who could support teachers' integration of technology into academic learning aligned to the SOLs.

The Virginia Department of Education is "walking the talk," dedicating all technology funds from the federal No Child Left Behind, Title II D allocation to professional development for learning and technology. Currently, Virginia's definition of a "highly qualified teacher" does not include literacy with technology. However, the Virginia Technology Standards for Personnel, in effect since 1998, require all instructional personnel to meet levels of technology proficiency beginning in the 2002-2003 school year (see additional information in the Professional Development section of this report).

Local Trends:

Rollout, Scope, and Focus:

Ready or not, 2001 saw thousands of high school students in Henrico County receiving individual laptop computers as part of the district's Technology and Learning Initiative. Their teachers had been given their own machines just one month prior, and most had never experienced the changes in classroom management that accompany ubiquitous access. Furthermore, the district's network infrastructure was anything but robust. Though the goals and expectations driving the laptop initiative were sound, the initial phases of the district rollout were poorly planned at best.

The good news is that educators in Henrico were quick to learn from their mistakes. The network was beefed up significantly, and middle school teachers in the county were issued their own machines a full year before students got theirs. In addition, students were trained on the laptops (using mobile carts) for a full semester prior to full implementation; it was not until January of 2003 that all students in grades 6 through 12 had been given Apple iBooks for use 24 hours a day, 7 days a week. Once that happened, it quickly became apparent that teachers would need significant support and professional development in redesigning their curricula to take full advantage of the laptops. One of the most effective ways in which the district provided this was by commissioning retired teachers to write such curriculum units and to serve as technology trainers for current Henrico faculty.

In Henry County, more upfront, comprehensive planning was done prior to the rollout of their laptop program. In August 1998, 4th and 8th grade teachers there participated in three days of staff development under the guidance of trainers from Apple Computer, Inc. They learned not only how to operate the particular computers their students would use, they collaboratively redesigned lesson plans to incorporate the technology into classroom activities. In October of that first year, parent training sessions (scheduled during both daytime and evening hours to accommodate work schedules) were also held in each of the schools housing 4th and 8th grade students. Parents, many of whom had no prior experience with computers, learned basic computer operation and maintenance, including simple troubleshooting techniques.

In November, approximately 1,400 students were trained by their core teachers to use the laptops. After the initial training, they began to use the technology both at school and at home to complete daily assignments. Teachers began to evaluate student work electronically, transferring their evaluations back to the students. The laptops were rolled out to 5th and 9th grade students the following year.

The original plan was to expand the original 24x7 one-to-one program through grade 12. Unfortunately, Henry County Public Schools encountered financial belt-tightening, so they used grant monies to buy classroom sets of laptops for their students instead. Today, teachers check out carts as needed, and everyone seems satisfied with this level of access. Students have network accounts through the district, which they are welcome to access from home if they have the technology. Even without 24x7 access, word processing, databases, spreadsheets, e-communications, and Internet research are a part of daily learning in Henry County.

3. What do Virginia’s policymakers expect will be the outcome of the ubiquitous computing initiatives in their state? Are these expectations the same as or different from those of educators? How are they aligned to Virginia’s overall education agenda?

Expectations:

Policymakers in Virginia have established expectations for technology in general. To date, they have established an expectation of a five-to-one computing ratio in Virginia’s schools, while acknowledging that eventually, given decreasing technology costs, that ratio will reach one-to-one.

<i>Expectations of Virginia Policymakers</i>	<i>Expectations of Educators in Henry County</i>	<i>Expectations of Educators in Henrico County</i>
<p>To date, state policymakers have not expressed specific expectations for one-to-one computing. However, their general expectations for technology use include:</p> <ul style="list-style-type: none"> ➤ Preparing the next-generation workforce for knowledge-based jobs that utilize cutting-edge information technology ➤ Supporting technology literacy at the 5th and 8th grade levels ➤ Facilitating higher student academic achievement and learning ➤ Professional growth for teachers and administrators ➤ Closing academic – including digital – divides among students 	<ul style="list-style-type: none"> ➤ Improving academic achievement (as linked to SOL scores) ➤ Preparing students for the real world/economic viability for communities ➤ Improving teaching and learning ➤ Closing the digital divide 	<ul style="list-style-type: none"> ➤ Improving academic achievement (as linked to SOL scores) ➤ Developing 21st Century Skills ➤ Meeting the needs (and maximizing the benefits) of multiple learning styles ➤ Facilitative, collaborative instruction using digital tools (both hardware and content) ➤ Closing the digital divide

Fit Within the Educational Agenda:

Significance:

Instead of setting a direct goal for one-to-one computing, the Commonwealth of Virginia has acknowledged that schools will require different configurations for different learning situations. At

this point in time, one-to-one is identified in the state technology plan as being a long-term goal—not currently under serious consideration by state legislators due to its high price tag and the state’s diminishing revenues. State legislators are not yet convinced that the phenomenon of one-to-one computing is worth the investment—despite the fact that Henrico and Henry Counties are nationally recognized as pioneers in ubiquitous computing.

School Improvement:

To date, the state has not linked ubiquitous computing to school improvement other than by generally acknowledging the advisability of using technology to streamline and enhance teaching and learning. Within that context, ubiquitous computing is mentioned as an option for school divisions only if they determine that it will optimally advance learning and school productivity.

Critical Factors:

School and district interviewees in Virginia identified the following as absolutely critical to the effective implementation of one-to-one programs:

- A robust, functioning network infrastructure
- Adequate technical support
- Adequate professional development and ongoing training in technology integration

Network Infrastructure:

Poor planning in the early stages of Henrico’s Technology and Learning initiative led to bandwidth and connectivity problems that ranged from moderate to severe. Fortunately, district and school leaders have since learned from their mistakes, and lessons have been widely shared among all stakeholders. This is especially true of the rollout to the middle schools, where principals and building level tech support personnel benefited from the experiences of their high school counterparts. Furthermore, an important addition to the technical support staff in Henrico was a network security position for the district.

Henry County educators agreed that a robust network was critical to effective implementation of one-to-one, but drew this conclusion from more positive experiences (see sidebar).

Technical Support:

Even prior to the laptop initiative, a strong foundation for technical support was in place in both Henrico and Henry Counties, and both districts assert the necessity of this factor in successful one-to-one programs, whether laptops are on carts or “belong” to individual students. In general, increases in tech support in both counties have been modest, though there has been significant realignment of duties to support one-to-one. A key to providing an adequate level of technical support was Henrico’s decision to

Example – A Robust Network in Henry County Public Schools:

Leaders in Henry County report being “*very happy*” with a state technology initiative that funded the building of a complete network in every school. They appreciate that the state went first for the network, then for a 1:5 computer to student **ratio** at the high school level. The idea was that once 1:5 was achieved in the high schools, they would go after the same access in the middle schools, and finally the elementary schools. “*I think they did it correctly,*” says the Henry County technology director. “*It’s very important that all schools and all grades have the same access, so the students don’t have machines one year, then none the next.*”

build the leadership capacity of department chairs, training them to support their faculty members.

In Henrico, each high school and middle school has a Technology Support Technician (TST) who is able to fix most hardware and network problems as they arise. Some schools also have part-time technology coordinators (in some cases, this is a role assumed by the assistant principal) who manage network and computer repair issues. Additionally, both districts make good use of students to assist with support, and teachers are willing to ask students for help. In both cases, provisions for support staff were built into existing technology costs in each district.

Finally, the JLARC report, *State Funding Formula for Educational Technology*, reported that the top priorities of school divisions, with respect to technology, are technical support, integration support, and the currency of technology equipment.

Professional Development and Technology Integration:

Technology trainers in each school are a critical element of Henrico County's successful one-to-one initiative. These are usually former classroom teachers with strong technology backgrounds who work with current teachers on topics related to technology integration. Training may take the form of workshops geared to particular topics, or may be individualized based on teacher needs.

"Teacher training is the most important way to prepare for one-to-one."

– Middle School Teacher, Henrico County Public Schools

Educators in Henry County firmly believe that teacher training is essential, and the district provided much of the up-front professional development teachers needed to get their one-to-one program off the ground. Unfortunately, budget cuts make finding ongoing professional development funding specifically geared to technology integration increasingly difficult. This issue may be partially alleviated through the professional development soon to be offered in every region of the state through NCLB Title II Part D, Enhancing Education Through Technology (EETT) funding. The Commonwealth of Virginia has elected to focus 100% of its competitive EETT funds on professional development for learning technology.

Assessment:

Since the state has not yet enacted any legislation for ubiquitous computing, there are, of course, no benchmarks or assessments specifically for one-to-one. However, the 2003-09 state technology plan does include a goal for accountability related to all technology investments (see below for more information):

Accountability Goal 1: Assess the value that information technology (IT) adds to teaching and learning environments.

Assessment is one of five key elements of the state's technology plan. But while Virginia does set clear standards for technology in general, these metrics have not been designed to directly address ubiquitous computing.

Metrics at the School and District Level:

Very little empirical data is available at this time for Henrico County, but academic achievement in general is on the rise, and there are some measurable gains that the district attributes to one-to-one. For example, when the program began in 2001, 80% of schools were state accredited, meaning that a required percentage of students pass the Virginia Standards of Learning (SOL) tests. By the fall of 2003, all regular schools in the district were fully accredited.

This past year, there was also a 13-point (district-wide average) gain in SAT scores, the lowest dropout rate in history, and the highest attendance rate in history. Anecdotal data from students is also very positive; the business community has given the program rave reviews; and teacher recruitment has been positively affected as well.

Furthermore, the district conducts general parent surveys every two years. On the latest surveys, 94% of more than 20,000 respondents reported being satisfied with the quality of education at the their child's school. Almost as many (90%) also reported that the principal and assistant principal at their child's school provide good leadership.

In 2002, SRI International received a National Science Foundation grant for evaluating ubiquitous computing in K-12 schools. As part of the project, SRI applied to Henrico to conduct a three-year evaluation of the district's ubiquitous computing initiative. This evaluation began in May of 2003 with site visits, interviews, and artifact reviews; student and teacher surveys are underway for the 2003-04 school year.

In Henry County, no formal evaluation is underway, though they have completed a 2000 survey from Virginia Tech and use a Standards of Learning (SOL) tracker for each grade level. Though they have plenty of anecdotal, hands-on evidence of the program's success (see below), they would like to collect more hard evidence because they believe that *"anytime, anywhere"* is important to student engagement and learning.

Technology Literacy:

Virginia is one of 37 states that has established technology literacy standards for students. In grades 5 and 8, that translates into specific technology literacy skills. In grades 9-12, it evolves into expectations that student levels of mastery in applying technology in their learning will increase. Prior to 1999, the state assessed technology literacy at the 5th and 8th grade levels via paper and pencil tests. According to the 2003-09 state plan, *"the state is exploring ways to assess the integration of technology skills into teaching and learning, and the ways technology supports school improvement efforts in Virginia."*

4. What funding mechanisms support ubiquitous computing in Virginia?

Funding:

While the state is not funding ubiquitous computing per se, it does support the building of a robust technology infrastructure in its school divisions through an annual allocation of approximately \$50 million per year. That level has been consistent over the past five years, and is slated to continue into FY2004.

In addition, in response to the JLARC report to the state legislature, the General Assembly is seriously considering an increase in technology funding to school divisions for technology staffing (both technical and integration specialists).

Direct and Indirect Costs:

Direct costs in Henry County consist of the laptops and the professional development training. “*We don’t like to start anything without training,*” says the district technology director.

Indirect costs include: finding (and financing) time for professional development, post-warranty repairs, and wiring issues in older buildings. With several years of experience under their belts, though, the district has “*gotten good at anticipating costs,*” so they no longer find themselves unprepared.

Sustainability:

In Henrico County, a 10-year plan with 4-year replacement cycles (matching the length of the district’s 4-year lease with Apple) is in place. To support the laptop program, the district has dedicated between 4 and 5% of its operating budget over 10 years. Parents are responsible for a \$50 annual insurance fee, which is reduced for students from lower income families.

Henry County administrators do not have such a formal sustainability plan in place. With state and district budget cuts, it has been harder and harder for the district to find funding for technology, though there are no plans in place to cut or scale back the one-to-one program.

5. What is the impact of ubiquitous computing on local school policies in Virginia?

In both Henrico and Henry Counties, one-to-one technology drives change in key ways. In Henry County Public Schools, the technology initially drove change, *“particularly at the teacher level,”* changing teaching and learning by making *“teachable moments”* more frequent. Now that they know what they can expect from the technology, they use it as a lever and support it strongly.

Local Impact:

Specific Subjects and School Populations:

Henry County's one-to-one program was designed from the start to benefit the community as a whole: students, educators, parents, and business/industry stakeholders. District interviewees cited the following outcomes of the one-to-one program to date:

- Student engagement and enthusiasm for the project is very high.
- The playing field is being leveled for economically disadvantaged students.
- Teachers are changing the focus of instruction from traditional paper/pencil methods to hands-on technology and electronic communication activities.
- Parents are acquiring new skills and an appreciation for technology as they participate in training sessions.
- The benefits of one-to-one for local business and industry are both immediate and long term. Since its inception, the project garnered national media attention, helping to attract new businesses to the area. In the long term, the project promotes the development of a 21st century workforce comfortable with and skilled in the use of technology.

“In an area where 46% of the population does not have a high school diploma, the laptop program is breaking new ground for a brighter future.”

– Superintendent, Henry County Public Schools

In Henrico County, the laptops are also used across all content areas, though science and social science teachers are getting perhaps the most meaningful use out of the technology's inclusion in teaching and learning. Primary uses across the curriculum include: Internet research, online content (through APEX Learning and Beyond Books), course-specific software and hardware (e.g., “Geometer’s Sketchpad, science probes), or the use of the creative aspects of the technology (e.g., iMovie).

Henrico County also hires teachers over the summer to develop curriculum materials appropriate for use in a digital classroom. They have enlisted the help of students in this area as well, and have received strong support from technology companies wishing to work with them in the development or use of course materials of materials.

“The laptops provide opportunities for kids to go places and do things they’ve never done before. It’s fantastic!”

– Teacher, Henrico County Public Schools

One of the most interesting outcomes of these summer sessions has been the creation of video vignettes for teaching a specific concept. Using the video vignette, a student (or teacher) can repeat instructions or concepts until he or she “gets it.”

Professional Development:

Example – Laptop Use in Henrico County Public Schools:

Students in Henrico County use their laptops to: view online art shows, attend virtual field trips, explore lab simulations (such as virtual dissections on Frog Guts.com), compare world history to up-to-the-minute current events, peruse vast health education materials, graph math and science concepts, take AP (Apex and Beyond Books) or vocational classes (enhanced by, for example, a virtual tour of an engine), chart their athletic progress, and more. [DO KIDS TAKE AP CLASSES ONLINE OR PARTICIPATE IN AP PREP? I THINK IT MAY BE THE

To prepare teachers for effective use of one-to-one in Henry County, district leaders offer at least 30-40 hours of intense training to participating teachers. They began by offering summer academies, but those filled very quickly. Now the district goes into the schools to train teachers during their planning periods (though they still offer some summer days). Beginning in July 2003, teachers in Virginia are required to pass a state technology competency test to get their licenses renewed, and Henry County thinks its teachers are ready. This requirement shifts responsibility from the school divisions to the state (prior to 2003, school divisions reported on teacher technology competency to the state).

Henry County schools have also conducted principal training since the summer of 2003, with the intent of seeing that technology is well supported at the administrator level. All of the principals in the district now have laptops for their own personal and professional use.

Prior to implementing their own ubiquitous computing initiative, Henrico County's professional development focus had been active, engaged teaching and learning aligned to continuous school improvement and accountability. In other words, professional development was an important aspect of the initiative, but it had already been an integral part of the life of every teacher in the district (approximately 1% of the district's total budget is dedicated to staff development).

Example – “Technology and Learning” Professional Development:

To support the laptop program specifically, Henrico County Public Schools provides release time, college credit, tuition reimbursement, financial incentives for attending professional development offerings outside of the school day (at \$18 an hour), and building level instructional support. For example, every middle and high school has a full-time technology trainer whose job it is to work with teachers, helping them to integrate computers and peripherals into their curricula, and technology integration workshops are available to teachers both during the academic year and during the summer.

There is informal professional development associated with the laptop program in Henrico as well: teachers collaborate more frequently, and departmental meetings often have time allotted to discussion of technology issues. Finally, teachers are given the chance to practice using the technology on their own, as teacher laptops may go home as well.

State Level:

While not directly supporting teacher readiness for ubiquitous computing, the Virginia Technology Standards for Personnel (8 VAC 20-25-30), in effect since 1998, require that all instructional personnel meet the following technology proficiency standards prior to the 2002-2003 school year:

- A. Instructional personnel shall be able to demonstrate effective use of a computer system and utilize computer software.
- B. Instructional personnel shall be able to apply knowledge of terms associated with educational computing and technology.
- C. Instructional personnel shall be able to apply computer productivity tools for professional use.
- D. Instructional personnel shall be able to use electronic technologies to access and exchange information.
- E. Instructional personnel shall be able to identify, locate, evaluate, and use appropriate instructional hardware and software to support Virginia's Standards of Learning and other instructional objectives.
- F. Instructional personnel shall be able to use educational technologies for data collection, information management, problem solving, decision-making, communication, and presentation within the curriculum.
- G. Instructional personnel shall be able to plan and implement lessons and strategies that integrate technology to meet the diverse needs of learners in a variety of educational settings.
- H. Instructional personnel shall demonstrate knowledge of ethical and legal issues relating to the use of technology.

Local Opinion: How Virginia Should Measure Success:

Though there is little yet in the way of hard, empirical evidence to illustrate the impact one-to-one has had on students in Henrico and Henry Counties (see above, Assessment), educators from both districts did share some observational or anecdotal evidence about the success of one-to-one. The following is a list of the most commonly cited observations, with the most frequently cited listed first:

- Student engagement/motivation is at an all time high
- Academic achievement is on the rise
- Attendance and graduation rates are up
- The digital divide is closing for students *and* their families
- Students are developing 21st century skills such as higher-order thinking

"With one-to-one in place, kids are collaborating, solving problems, doing research, and actually constructing knowledge. It's like nothing we've seen before to this degree."

– Superintendent, Henrico County Public Schools

- Teachers are becoming more facilitative; students and teachers are interacting more
- Students are better organized

In both districts, as elsewhere, there is a sense that the traditional measures of success are inadequate. Policymakers, say Virginia educators, need to acknowledge that the positive results of one-to-one are far greater than those that can be quantitatively measured.

State Response:

Since the state sees ubiquitous computing as a long-term goal toward which its diminishing student-to-computer ratio is heading, it seems reasonable to assume that Virginia's accountability measures for ALL technology investments are those identified in the state technology plan:

Accountability Goal 1 • Assess the value that information technology (IT) adds to teaching and learning environments:

Target 1. Identify elements of technology integration that benefit the teaching and learning environment.

Target 2. Readiness to integrate technology into teaching and learning has been assessed for each school.

Target 3. Instructional technology integration has been assessed in schools and classrooms.

Target 4. Technology-rich environments and effective technology-based instructional strategies support student learning.

Accountability Goal 2 • Provide appropriate decision support capabilities for all stakeholders:

Target 1. Information systems provide comprehensive information about student learning progress.

Target 2. Information systems interface to provide staff members the ability to use appropriate and effective data to make decisions.

Accountability Goal 3 • Assess information technology (IT) literacy:

Target 1. All students are technology literate.

Target 2. All instructional personnel are technology literate.

Target 3. All paraprofessionals and support staff are technology literate.

Target 4. Students meet expectations for technology utilization pertaining to their subject and grade level as described by school division technology plans.

Accountability Goal 4 • Ensure that local technology plans are consistent with the state technology plan:

Target 1. School divisions will have technology plans that are consistent with the components of the state technology plan. All schools will have technology plans that are consistent with the components of their division technology plan.

Target 2. All schools and school divisions will evaluate annually the progress and effectiveness of their technology plans.

Source: 2003-09 Educational Technology Plan for Virginia – Executive Summary: pp. 7-8.

6. What were the unintended consequences, negative and positive, of the laptop initiatives in Virginia?

The Good:

- Teacher enthusiasm, retention, and recruitment
- Parental involvement in school and increased technology literacy

Teacher retention and recruitment:

One principal in Henrico County reported that, as a result of the iBook initiative and a recent recruiting trip, the school division has been “inundated” with applications from teachers in nearby states and counties, potentially attracting a higher caliber of teacher.

“I planned to retire last year, but I am so excited about this project that I decided to continue and be part of it.”

–4th grade teacher, Henry County Public Schools

Parent Involvement and Technology Literacy:

Teachers and administrators in both districts report that communication with families has improved. According to a one high school administrator in Henrico County, the laptop initiative is responsible for building this communication more than ever through web-based services that give parents access to student grades.

A related home-school benefit in both Henry and Henrico Counties has been the elimination of the digital divide – even at home. By opening up the resources of the Internet in many students’ homes (through home computer Internet access provided by Henry, and through both hardware and low-cost access provided by Henrico), districts also open the door to the future for many families.

Example – Parent Involvement in Henry County:

A parent described the sense of enthusiasm and engagement the first day her son brought his laptop home: *“He wanted to show me all the things that he could do with his computer, and he also wanted me to do the same things that he had learned.”*

Example – Parent Inclusion in Henrico County:

Henrico’s middle school parents were provided numerous opportunities to learn about the laptops during 90-minute training sessions that took place during the fall of 2002. Parents were required to attend at least one session, but others were offered to those wishing to learn more than the basics of laptop care and operation. “We were always packed for those sessions,” said one middle school teacher. Middle school students received their laptops in January of 2003.

Remaining Challenges:

In addition to the positive “unexpecteds” both districts reported above, educators in Henrico County found the following to be areas in need of improvement:

- Durability of hardware/frequency of repairs
- Time

Durability of Hardware:

One of the biggest, ongoing challenges in Henrico County is the frequency of needed repairs to the laptops. According to some participants, a single school might have as many as 100 repairs a week. One technology coordinator noted that, *“the repair issue is the most daunting piece of the whole puzzle to me.”*

Some teachers noted the importance of having desktop computers available in classrooms to substitute for the student computers that may be being repaired. The district discourages sharing of laptops for liability reasons.

Time:

Teachers and administrators in Henrico County express some frustration at not being able to explore the full potential of the laptop technology. A key barrier is simply time – time to practice newly acquired skills, time to locate and assess additional content, and time to further refine teaching or administrative practices so that full advantage might be taken of the quality management and teaching tool at their disposal.

Laptop management efforts, especially in a program of such a large scale, also require significant time. Assistant principals, for example, may assume the role of technology coordinator, adding to their already full schedule time for coordinating repairs or school-wide checks of appropriate student use.

Henry County educators could not cite any specific, ongoing challenges to one-to-one besides funding, which is addressed above.

7. What are the next steps for Virginia?

Next Steps:

Virginia's education leaders are forward thinking and committed to technology use, which bodes well for the future. Consider the following statement from the state Superintendent in regards to the newest 6-year technology plan: *"The state plan establishes a shared vision for using technology. It sets short-term and long-term goals for technology use, and heightens the awareness of stakeholders to the value of planning for the use of technology in schools. And, most of all, the purpose of the state plan is to enhance students' academic achievement through the use of technology."*

While Virginia policymakers, due in part to severe budget short falls in the Commonwealth in the last few years, are not currently considering a statewide ubiquitous computing initiative, their emphasis on and support for technology-based learning in general is encouraging. Furthermore, as has been the case with other educational trends in Virginia, it is important to note that the leadership of pioneering local schools and divisions has put one-to-one on the radar screen of state legislators.

Advice to Other Educators:

Local Level:

In Henrico and Henry Counties, the advice to other educators was:

"Changes in teaching methodology have been phenomenal."

"In this environment, the learning doesn't stop just because the teacher's not around."

"The laptops provide opportunities for kids to go places and do things they've never done before."

"Don't be afraid to try new technologies. There are challenges, but there are rewards."

"You need to have people in place to make the transition to effective technology use easy."

State Level:

“It is not a question of IF, but rather WHEN. The Commonwealth is slowly easing its way toward one-to-one, with 2004 student-to-computer ratios reported at 4:1 and counting down.”

“You can’t mandate the really important things—effective use of technology in schools. The Commonwealth of Virginia is investing in the infrastructure of the state’s school divisions, so that WHEN they see academic value to ubiquitous computing, the network will be ready.”