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SEVEN STEPS TO

**IMPROVING LEARNING OUTCOMES**

WITH TECHNOLOGY-ENABLED 1:1 LEARNING

A White Paper for Educators from **lenovo** **FOR**  
**THOSE**  
**WHO DO.**

**EXECUTIVE SUMMARY:**

**LEARNING OUTCOMES IMPROVE AS 1:1 LEARNING TAKES HOLD**

If there is any doubt that education in the United States is in crisis, consider these two recent events:

- In New York City, Mayor Michael Bloomberg froze teacher salaries rather than hand out pink slips to approximately 4,400 teachers.
- California’s State Superintendent of Public Instruction Jack O’Connell worried about the impact of \$17 billion in cuts to education in his state saying, “I fear that the progress we’ve made for seven years is likely to be completely derailed and our efforts to close the achievement gap will be an afterthought.”

Against this discouraging backdrop, one conclusion is clear: The traditional “read, recite and repeat” approach to education cannot produce graduates with the critical thinking skills needed to excel in today’s all-digital world.

Teaching and operational experts consistently point to 1:1 learning as an optimal way to customize education for each student. This approach leverages breakthrough thinking such as that embodied in P21, New Blooms and the Educational Research Institute to leverage each student’s strengths and build skills from there. However, 1:1 depends on each student having access to technology—not just to create “educational parity” but to fuel the desire to learn as well.

**“The illiterate of the 21st Century will not be those who cannot read or write, but those who cannot learn, unlearn and relearn.”**

*Futurist Alvin Toffler*

Today, millions of students and teachers worldwide are experiencing 1:1 learning—in the United States’ Maine and North Carolina as well as in emerging regions of the world such as Peru.<sup>1</sup>

Why are K-12 schools embracing 1:1 learning? There are two primary reasons:

- to improve learning outcomes;
- and to boost the operational efficiency and cost-effectiveness of teachers, staff and administration.

1:1 learning makes extensive use of technology, offering educators a way to individualize learning by acknowledging each child’s strengths and areas for improvement, and building skills from there. This approach holds particular appeal for educators in the United States where student populations reflect diversity in culture, language and skills.

**In addition to the diversity of U.S. students, the need for graduates with critical thinking skills, shrinking educational budgets and the proliferation of national and statewide testing programs adds to the pressure to rethink the way students learn.**

Through 1:1 learning, each student can have a personalized educational experience which leverages his or her strengths and delivers extra help as needed. Because technology enables progress monitoring in real time, teachers can intervene long before a failing grade occurs.

In this white paper, we examine the positive impact that 1:1 computing is having on *learning outcomes*. We also review *seven important areas* that can *affect the success* or failure of your 1:1 learning initiative and its ability to improve learning outcomes.

But before we start, let's look at an important and well-documented result:

- The North Carolina 1:1 Learning Technology Initiative (NCLTI) reported 92% attendance rates for students, increased graduation rates, lower dropout rates and higher teacher retention since its pilot 1:1 learning program began three years ago. Not only did disadvantaged students post improved test scores, all students substantially increased their writing scores. In addition, teachers used the 1:1 program as an opportunity to improve their preparation and incorporate more technology-delivered content in their lessons.

### SEVEN STEPS TO IMPROVING LEARNING OUTCOMES

Many educators and administrators with the flexibility and budget to launch a comprehensive 1:1 initiative do just that. Others, however, may choose to launch a pilot program. In creating a pilot program, some schools include a sample student population with a common characteristic, such as students enrolled in schools located in rural areas. Other schools opt to divide a similar student population, exposing one half of the students to technology-enabled learning, while the remaining students work without technology.

No matter which approach to 1:1 makes the most sense based on your needs, expectations and budget, one conclusion is clear: advance planning is crucial to success. Leading administrators and teachers who are pioneering 1:1 point to seven key areas critical to improving learning outcomes:

- Policy,
- Training,
- Curriculum,
- Content,
- Devices,
- Assessment, and
- Classroom Management.

Each area represents an opportunity to influence learning outcomes positively.



## POLICY

The first area of attention, policy, begins with building consensus and setting clear expectations. Savvy educators intentionally set out prescriptive policies to govern each major aspect of the 1:1 program, such as:

- Funding and sustainability,
- Communications,
- Site readiness,
- Academic readiness,
- Results reporting, and
- Security and privacy.

Building these policies in advance gives you an opportunity to solicit ideas before finalizing program elements. In addition, collecting these individual policies allows you to construct a “1:1 blueprint” that will be invaluable as you refine and expand the program later.

### Funding and Sustainability

Rather than focusing on immediate revenue sources only, look for sustainable financial support as well. While it’s true that you’ll need to identify initial funding to make the 1:1 initiative a reality, it’s even more important that you pinpoint sources of sustainable funding to keep the effort going. Learning outcomes improve during the initial years of a 1:1 program and they continue to grow over time, according to multi-year reports from North Carolina. This makes the program’s sustainability critical. Include 1:1 learning expenses in the fixed cost of your budget and you’ll help ensure that 1:1 endures. Include 1:1 costs in only the variable portion of your budget and you may find yourself in the precarious position of having to fight for budgetary allocation every year.

### Communications

To build support for your 1:1 efforts, set out a plan of strategically timed communications to share information, status and progress with decision makers from education, administration and IT. Remember to first focus on the promise of 1:1 to improve learning outcomes – a common goal shared by key stakeholders. These communications will need to be crafted to resonate with key internal audiences, such as boards of education, teachers and staff, as well as external stakeholders, including parents and students. Schools seeking financial or “in kind” support from the local business community will need to communicate the 1:1 plan with influential civic and business leaders as well. When it comes to evangelizing 1:1 learning, the best advice is this:

**Communicate early and often with everyone who has an interest in bettering students’ learning outcomes.**

### Site Readiness

Assuming that your campaign for 1:1 learning is gaining momentum with your key supporters, turn your attention to the individual schools slated to participate in the program. Each site will need to be evaluated as to its readiness, from a technology standpoint and an academic perspective. In addition to satisfying technology requirements, academic readiness is equally important.

### Academic Readiness

Once you've evaluated a school's site readiness, it's time to focus on teachers, a key pillar in 1:1. You'll need to determine how much of teachers' course materials are available electronically and how much must be converted from paper. After you've identified the gaps, you'll need to create a process for completing the content repository from which teachers will plan their lessons.

**An equally important part of academic readiness relates to training and professional development for teachers, staff and administrators.**

Teachers' technology skills need to begin with baseline computer use and expand to address how to use the computer to teach. Knowing how to leverage computers to convey instructional material empowers teachers to rethink their lesson plans and see learning in a media-rich, new way.

### Results reporting

One of the common oversights of 1:1 centers on the necessity to establish educational goals in advance of rolling out technology. It is imperative that educators measure against these desired learning outcomes to demonstrate the effectiveness of 1:1 and to identify opportunities for improvement.

Assistance specific to collaboration, results reporting, and trending and analysis will also be needed as teachers become more comfortable with the technology. 1:1 collects the data needed to track individual academic results and compare those results to group performance, putting into perspective each student's progress. You'll need to work with teachers, staff and administrators to isolate critical success factors and integrate them into online dashboards, graphical representation of academic progress.

As you can see, a wealth of student-, class-, teacher-, grade- and regulator-specific performance data will be collected during the 1:1 experience. You'll need policies to govern how this information will be shared, to whom it will be made available and how it will be used to comply with local, state and federal educational mandates, such as The No Child Left Behind (NCLB) Act of 2001.

### Security and privacy

Thoughtful policies on students' computer usage, security and privacy issues ensure that students are safe online. For example:

- Will each student have his or her own laptop to take home, or will laptops be secured at school and distributed only during class sessions?
- Who will be responsible for lost or damaged laptops – students, parents or teachers?
- How will you handle replacement of missing laptops?
- Will you be able to erase laptop contents remotely in the case of theft or loss?
- Will you make "loaner" laptops available?
- How will content filtering software be set to enable educational searches, while protecting students from being exposed to sites with unacceptable content?

## SAMPLE LIST OF RECOMMENDED USAGE POLICIES<sup>2</sup>

Prescriptive policies addressing each of these concerns offer an optimal way to keep the various schools “on the same page” when it comes to 1:1 learning. While it’s recommended that each school system or district, create its own unique checklist, the following list of baseline policies offers a place to start:

- Set out acceptable use guidelines
- Recommend care for laptops
- Block access to violent games and social networking
- Require originally installed software to remain on the laptop
- Prohibit installation of additional software
- Create a reliable, easy-to-use laptop tracking system
- Consider random inspections to check condition and software
- Collect insurance fees from students
- Decide if students can take laptops during the school year, for the summer
- Secure written permission from parents before distributing laptops



### TRAINING

The far-reaching potential of 1:1 to transform students’ educational experience requires that everyone involved understand how to leverage technology for their specific purpose—teachers, content creators and suppliers, technical and teaching support staff, and administrators. That understanding hinges on the availability of training tailored to meet the needs of each educational constituency.

**Teachers involved in 1:1 programs cited their own lack of training as the most significant barrier to laptop use in the classroom.<sup>3</sup>**

Expect this frustration to multiply if you distribute laptops to students before teachers know how to use the devices themselves and how to use them to teach.

While baseline training concentrates on building computer literacy, 1:1 also requires a full range of technology integration capabilities. For example, teachers who comfortably move from application to application and from the Internet to content creation and distribution software and back again will gain the most from 1:1. Their lesson plans and course materials will showcase a full range of rich media to engage students in the learning process.

In its state-wide 1:1 learning initiative, “Classrooms for the Future,” Pennsylvania allows most of the 1:1 implementation and support decision-making to be made at the local level. However, the state focused particular attention on professional development for teachers. The state’s three-pronged professional development approach included:

- “Hands on” training provided onsite by technology vendors.
- Online courses for groups of teachers and co-teachers to take together.
- Ongoing access to a locally based team of instructional coaches.

To recognize the value of ongoing professional development, the state underwrites half the cost of

the locally based instructional coaching team.

“Students now own their learning,” said Holly Jobe, project manager, “Classrooms for the Future” initiative. “When the teacher gives a question, they research it and think about possible solutions. Then, they explain why their solution works.”



## CURRICULUM

Opportunities to fine-tune your 1:1 program abound in the curriculum area. It is here that you can tailor your curriculum and electronic courseware to take into account the need to satisfy state standards and academic testing mandates. For example, past testing may have identified particular areas of academic concern. You'll want to use 1:1 as an opportunity to strengthen or even expand time spent in those areas.

**You may decide to emphasize certain learning areas to prepare your students for success in specialized local job markets.**

For example, if your students need English as a second language training or if manufacturing jobs dominate the local job market, now is the time to build instruction around those specialized requirements via your 1:1 curriculum. This phase of 1:1 preparation provides schools with an opportunity to enlist educational experts, civic leaders and hiring companies in a truly collaborative curriculum-setting process designed to equip students with marketable, in-demand skill sets.



## CONTENT

In the age of traditional print and production, content waited as much as seven years to make its way into a textbook's next revision. In the digital age, that interval feels like light years. That's because etextbooks and ebooks can be updated quickly and easily, via the Internet, compressing the cycle time between revisions from years to days. Today's ebooks cost less than traditionally printed volumes and add virtually no weight to students' already bulging backpacks. The Internet delivers a wealth of fresh content to teachers and students every day, and most of it is available free of charge.

In addition, teachers can access a host of educational resources on a subscription basis. These grade-specific resources include information, tools and materials appropriate to subjects such as English, history, science, mathematics and Spanish. Each level-specific subject area also features interactive components, such as games, that incorporate and expand students' critical thinking skills. Sets of measure outcomes tailored to the subject matter and grade level complete each resource. These rich media experiences experience can convert even the most passive student into an actively engaged learner.



## DEVICES

As you think through your school’s approach to 1:1, you’ll be evaluating several different types of computing devices to find the ones most appropriate to your learning goals. Because no one device delivers full functionality and complete mobility, you’ll likely find that device preferences will vary by application.

### 1:1 K-12 LEARNING DEVICES AT-A-GLANCE COMPARISON

| Device      | K-12 Capabilities   | Benefits  | Considerations   |
|-------------|---|---|--|
| Netbooks    | <ul style="list-style-type: none"> <li>• Simple learning tasks, such as:</li> <li>• Note taking</li> <li>• Web/Internet Research</li> <li>• Email</li> </ul>  | <ul style="list-style-type: none"> <li>• Mobility</li> <li>• Ideal for simple computing tasks</li> <li>• Serves as a companion device to traditional PC</li> <li>• Price</li> </ul>   | <ul style="list-style-type: none"> <li>• Durability</li> <li>• Minimal processing power</li> </ul>   |
| Laptops     | <ul style="list-style-type: none"> <li>• Includes most functionality of netbooks, <b>plus:</b></li> <li>• Handles complex learning applications such as MS Office and Adobe Digital School Collection</li> <li>• Light weight</li> <li>• Full-size keyboard</li> <li>• Durable</li> </ul> | <ul style="list-style-type: none"> <li>• Mobility extended learning beyond the classroom</li> </ul>   | <ul style="list-style-type: none"> <li>• Must manage battery life and connectivity</li> <li>• Can be heavy for younger, smaller students</li> </ul>                  |
| Tablets     | <ul style="list-style-type: none"> <li>• Includes most functionality of laptops, <b>plus:</b></li> <li>• Touch screen</li> <li>• Digitizer pen to take notes, draw diagrams, fill in forms and applications quickly</li> <li>• Simple, and demanding learning applications</li> </ul>     | <ul style="list-style-type: none"> <li>• Best integrates learning across multiple subjects and across multiple grades</li> <li>• Mobility extends learning beyond the desk</li> </ul> | <ul style="list-style-type: none"> <li>• Must manage battery life and connectivity</li> <li>• Can be heavy for younger, smaller students</li> <li>• Price</li> </ul> |
| All-in-ones | <ul style="list-style-type: none"> <li>• Includes most functionality of tablets and laptops, <b>plus:</b></li> <li>• Space-saving single desktop-monitor unit</li> </ul>  | <ul style="list-style-type: none"> <li>• Ideal for small, tight spaces</li> <li>• Great price-to-performance ratio</li> </ul>   | <ul style="list-style-type: none"> <li>• Fixed location</li> </ul>   |
| Desktops    | <ul style="list-style-type: none"> <li>• Includes most functionality of tablets, laptops and all-in-ones</li> </ul>   | <ul style="list-style-type: none"> <li>• Runs complete range of learning software applications</li> <li>• Great price-to-performance</li> </ul>                                       | <ul style="list-style-type: none"> <li>• Fixed location</li> <li>• Requires additional monitor</li> <li>• Larger space (footprint) required in classroom</li> </ul>  |

Both laptops and tablets enable K-12 students to fully experience 1:1 learning. For example, these mobile devices are lightweight, weighing less than three pounds. Intel processors ensure fast performance, while battery advances deliver all-day computing power. A full-sized, ergonomic keyboard brings familiarity to computing, and durability ensures the devices can take everything a K-12 student dishes out—even when students keep them 24/7. Advanced security settings keep students safe and secure online.

To extend learning “beyond the desk,” consider converting desktop devices to tablets. Using a digitizer pen, students can jot notes and draw diagrams quickly. Students can even flip and erase using a pencil and palm-rejection technology that prevents hands from interfering with writing. An enhanced finger-touch sensitivity on multi-touch screens allows students to quickly complete applications and forms.

If you’re looking for a smaller mobile device at a lower cost, consider netbooks. These devices, which are ideally suited for email and note taking, originally served as companion devices to traditional PCs. For that reason, they lack a fully functioning operating system, which prevents them from efficiently running applications such as Adobe® Digital Creative Suite and Office® from Microsoft®. In addition, netbooks lack the durability of laptops and desktops. However, in cost-constrained environments where students don’t need full-featured laptops or desktops, netbooks offer an affordable alternative for 1:1 learning.

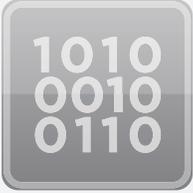
If space is a limiting factor, desktops and all-in-one machines offer multiple model types designed to fit even the most limited of spaces. These devices feature lightning fast processors. All-in-ones combine the traditional desktop and monitor into one PC, making it perfect for self-service “information” stations. Desktops deliver the same durability, advanced security and data protection as mobile machines, making desktop the best choice when mobility is not required.

Regardless of the device combinations you employ in 1:1 learning, each should be customized for your school with an advanced operating system, a full set of productivity-enhancing applications, digital media tools and collaborative software. Intel processors reliably deliver the computing power needed to fuel 1:1 learning.

Standardizing your school’s 1:1 learning program on the Windows® operating system and software such as Office, Adobe® Digital School Collection and Sharepoint™ leverages teachers’ familiarity with this computing environment. In addition to being easy to use for teachers, staff and administrators, a universal environment allows students to build their computing competencies on the electronic platform they are most likely to use after graduation.

Your preferred device combinations should allow anyone to create and distribute eportfolios—topic-specific collections of rich content. Teachers, staff and administrators can share their eportfolios of best practices quickly and easily. Additionally, teachers can create, standardize and evolve their course materials over time in class- or subject-specific eportfolios, while students can document their measurable progress for parents and teachers alike.

**Wherever devices will be used by students or teachers, plan to provide a full array of charging options, such as banks of electric outlets and charging carts. For safety reasons, it’s recommended that power cords not be used to recharge devices.**



## ASSESSMENT

Teachers in 1:1 schools have a wealth of performance data on their PCs. This data becomes an “early warning system” or leading indicator for teachers, identifying the students who require additional attention and even specifying the sections that are proving troublesome. In addition, 1:1’s individualized approach to learning enables teachers to fine-tune their course materials as needed based on class comprehension and retention.

Additionally, having student-specific data online allows educators to share results with parents easily and at any time during the learning period.

**For parents and teachers, 1:1 could also be called the “no surprises” approach to learning. No longer will a parent have to wait until report cards come out to know how a student is performing.**

Finally, individualized performance data can be “rolled up” to show trends across classes, departments, schools, districts and even states. This same data also proves invaluable as school systems and districts quantify their results for state regulators and local boards of education.



## CLASSROOM MANAGEMENT

While it may seem that students are the ones benefitting the most from 1:1, this approach to individualized learning helps teachers as well.

*Teachers who resist the 1:1 learning model most often point to losing control over the classroom as the reason they are reluctant to support the concept.* In actuality, the reverse is true. 1:1 learning actually gives teachers more control over their classes. For instance, technology enables teachers to control each student’s laptop, assuring that everyone sees the same information and images at the same time. In addition, technology also allows instructors to “black” each student’s laptop at one time, re-focusing student attention up front to the teacher.

**When a student produces work that can be useful to the entire class, the instructor can electronically send that work to each laptop at the same time, focusing the class on the excellent result and how it was achieved.**

Advanced polling capabilities engage students in educational content, allowing them to express their opinions individually and see what their classmates think as well. Finally, teachers can easily tell where each student is in terms of moving through the content via pacing. This “early warning” system shows teachers which students are moving through the content effortlessly and need to be challenged more, while isolating students who need personalized attention to master troublesome concepts.

**CASE STUDY:**

**NORTH CAROLINA ENHANCES LEARNING OUTCOMES WITH 1:1 LEARNING**

In North Carolina, a 1:1 learning pilot program spanning eight schools began with a total student population of 2,000 and staff of 200. A subsequent three-year study tracked results at the original seven early college high schools (ECHS) which implemented 1:1, a control group of seven additional ECHS that did not implement 1:1, a large traditional high school which implemented 1:1 and a matched traditional school without 1:1. For each year of implementation, the study tracked results associated with a unique question:<sup>4</sup>

- Year 1 – Are school leaders, teachers, students and parents ready to utilize the laptops in instruction, and what implementation issues impact their readiness?
- Year 2 – Is classroom instruction changing?
- Year 3 – What are the achievement outcomes of the initiative, and is the environment sustainable?

In a report to the North Carolina legislature, North Carolina Learning Technology Initiative (NCLTI) educators pointed to increased engagement by teachers and students alike as a key benefit of the 1:1 effort. They also stressed that “more active, reflective, collaborative and project-based learning” took place after technology debuted into the classroom.<sup>5</sup>

A collaboration between the public and private sectors, NCLTI supplies computers to students and teachers located in the state’s rural areas. The effort also helps schools develop the technical infrastructure to support Internet access, multimedia curricula and teacher training.

**TIMING IS CRITICAL TO 1:1 SUCCESS<sup>2</sup>**

- Timing really is everything.
- “Floaters” routinely save the day.
- Learning outcomes improved and continue to do so.

North Carolina Learning Technology Initiative (NCLTI) reported that planning and preparation for 1:1 learning requires a minimum of six months.<sup>6</sup> Based on their experience, North Carolina educators recommended that this important six-month period take place in a prior school year. That timing allows students to receive laptops at the beginning of the subsequent academic year—after the technical infrastructure has been placed and tested, and after teachers’ professional development has been completed.

**North Carolina 1:1 Learning Initiative Pilot  
TRADITIONAL SCHOOL<sup>7</sup>**

| ACTIVITY   | TIMING            |
|--|-------------------|
| Laptops distributed to teachers  | March             |
| Technology staff begins building infrastructure (wireless, laptop imaging, software loading) | Spring and Summer |
| Professional development for teachers begins   | Spring and Summer |
| Laptops distributed to 1,266 students  | September         |

**North Carolina 1:1 Learning Initiative Pilot  
EARLY COLLEGE HIGH SCHOOL<sup>8</sup>**

| ACTIVITY   | TIMING       |
|--|--------------|
| Laptops distributed to teachers  | November     |
| Technology staff begins building infrastructure (wireless, laptop imaging, software loading) | November     |
| Professional development for teachers begins   | November     |
| Informational sessions for parents   | March, April |
| Students receive laptops   | March, April |

Educators involved in the North Carolina pilot called ongoing content-based professional development “imperative” and cited the contribution of on-site technology facilitators (TFs) as “significant.” They pointed out that “floating” TFs, which could be consulted as needed, supplemented schools’ standard information technology (IT) staff. TFs not only supported teachers as they learned how to use the computers, the TFs collaborated with the teachers to:

- Develop technology-integrated lessons,
- Demonstrate how technology could enhance and support the teaching and learning processes, and
- Shared digital resources that could be used to supplement lessons.

North Carolina educators emphasized the need to ensure student safety without limiting access in ways “that interfere with educational uses” of technology.<sup>9</sup>



## LENOVO IS YOUR PARTNER FOR 1:1 LEARNING

Technology, the foundation of 1:1 learning, offers teachers and students access to a wealth of rich media and information to stimulate thinking in new ways.

Implementing an educational imperative as transformative and visible as 1:1 learning comes with its own set of challenges. Focusing on the seven areas outlined in this whitepaper will help schools and districts create a “1:1 blueprint” tailored to their own site-specific needs.

No matter which approach to 1:1 learning you take, one conclusion is clear: computing devices should enhance and support academic achievement—not detract from it. Educators can fuel students’ desire to learn by making classes challenging and fun—two objectives accomplished through 1:1. However, putting computing devices at the center of learning means that each device needs to be durable and reliable, appropriate to the task and centrally controlled.

At Lenovo, we’ve made 1:1 learning come alive for millions of students and teachers. How can we help you bring your students into the learning-empowered digital age?

### ENDNOTES

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- <sup>1</sup> “New Millenium Learners Conference 2010 – Day 1”, OLPC News, 2010. Accessed online September 5, 2010 from [http://www.olpcnews.com/implementation/new\\_millenium\\_learners\\_conference\\_day\\_1.html](http://www.olpcnews.com/implementation/new_millenium_learners_conference_day_1.html)
- <sup>2</sup> Corn, J. et al, “Results from North Carolina’s 1:1 Learning Initiative Pilot” 2009. Accessed June 10, 2010 online from [http://www.iste.org/Content/NavigationMenu/Research/NECC\\_Research\\_Paper\\_Archives/NECC2009/Tingen\\_NECC09.pdf](http://www.iste.org/Content/NavigationMenu/Research/NECC_Research_Paper_Archives/NECC2009/Tingen_NECC09.pdf)
- <sup>3</sup> Corn, J. et al, “Results from North Carolina’s 1:1 Learning Initiative Pilot” 2009. Accessed June 10, 2010 online from [http://www.iste.org/Content/NavigationMenu/Research/NECC\\_Research\\_Paper\\_Archives/NECC2009/Tingen\\_NECC09.pdf](http://www.iste.org/Content/NavigationMenu/Research/NECC_Research_Paper_Archives/NECC2009/Tingen_NECC09.pdf)
- <sup>4</sup> Corn, J. et al, “Results from North Carolina’s 1:1 Learning Initiative Pilot” 2009. Accessed June 10, 2010 online from [http://www.iste.org/Content/NavigationMenu/Research/NECC\\_Research\\_Paper\\_Archives/NECC2009/Tingen\\_NECC09.pdf](http://www.iste.org/Content/NavigationMenu/Research/NECC_Research_Paper_Archives/NECC2009/Tingen_NECC09.pdf)
- <sup>5</sup> Corn, J., Emer, P., “NC 1:1 Learning Technology Update,” presented to the Joint Legislative Education Oversight Committee, 2010. Accessed June 4, 2010 from [http://www.fi.ncsu.edu/blog/friday-institute-news/2010/02/17/the-legislature-is-updated-regarding-nclti-/](http://www.fi.ncsu.edu/blog/friday-institute-news/2010/02/17/the-legislature-is-updated-regarding-nclti/)
- <sup>6</sup> Corn, J., Emer, P., “NC 1:1 Learning Technology Update,” presented to the Joint Legislative Education Oversight Committee, 2010. Accessed June 4, 2010 from [http://www.fi.ncsu.edu/blog/friday-institute-news/2010/02/17/the-legislature-is-updated-regarding-nclti-/](http://www.fi.ncsu.edu/blog/friday-institute-news/2010/02/17/the-legislature-is-updated-regarding-nclti/)
- <sup>7</sup> Corn, J. et al, “Results from North Carolina’s 1:1 Learning Initiative Pilot” 2009. Accessed June 10, 2010 online from [http://www.iste.org/Content/NavigationMenu/Research/NECC\\_Research\\_Paper\\_Archives/NECC2009/Tingen\\_NECC09.pdf](http://www.iste.org/Content/NavigationMenu/Research/NECC_Research_Paper_Archives/NECC2009/Tingen_NECC09.pdf)
- <sup>8</sup> Corn, J. et al, “Results from North Carolina’s 1:1 Learning Initiative Pilot” 2009. Accessed June 10, 2010 online from [http://www.iste.org/Content/NavigationMenu/Research/NECC\\_Research\\_Paper\\_Archives/NECC2009/Tingen\\_NECC09.pdf](http://www.iste.org/Content/NavigationMenu/Research/NECC_Research_Paper_Archives/NECC2009/Tingen_NECC09.pdf)
- <sup>9</sup> Corn, J., Emer, P., “NC 1:1 Learning Technology Update,” presented to the Joint Legislative Education Oversight Committee, 2010. Accessed June 4, 2010 from [http://www.fi.ncsu.edu/blog/friday-institute-news/2010/02/17/the-legislature-is-updated-regarding-nclti-/](http://www.fi.ncsu.edu/blog/friday-institute-news/2010/02/17/the-legislature-is-updated-regarding-nclti/)

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