



Classroom eLearning: Moving Beyond PC Labs

Integrating ICT into core instruction delivers more educational and financial value than traditional PC labs and paves the way to full 1:1 eLearning



One-to-one eLearning is increasingly recognized as the most effective way to incorporate information and computing technologies (ICT) into K-12 education. In a fully realized 1:1 eLearning environment, each teacher and student uses a dedicated, Internet-connected laptop throughout the day. Teachers are well-trained and confident at using technology across the curriculum, and can access a wide range of localized educational materials. Lessons are project-based and student-centered, and children develop 21st skills such as critical thinking and collaboration.

Classroom eLearning, which brings technology into the classroom, has emerged as the best alternative for school systems that are not ready to implement 1:1 eLearning, or want to move incrementally toward a 1:1 environment. Using mobile carts or computers on wheels (COWs), classroom eLearning delivers significantly more value than traditional PC labs and helps school leaders develop the expertise and skills needed for successful 1:1 eLearning.

Classroom eLearning allows students and teachers to experience the benefits of increased technology access, while enabling policymakers, administrators, and teachers to develop the expertise, skills, and confidence needed for successful adoption of 1:1 eLearning.

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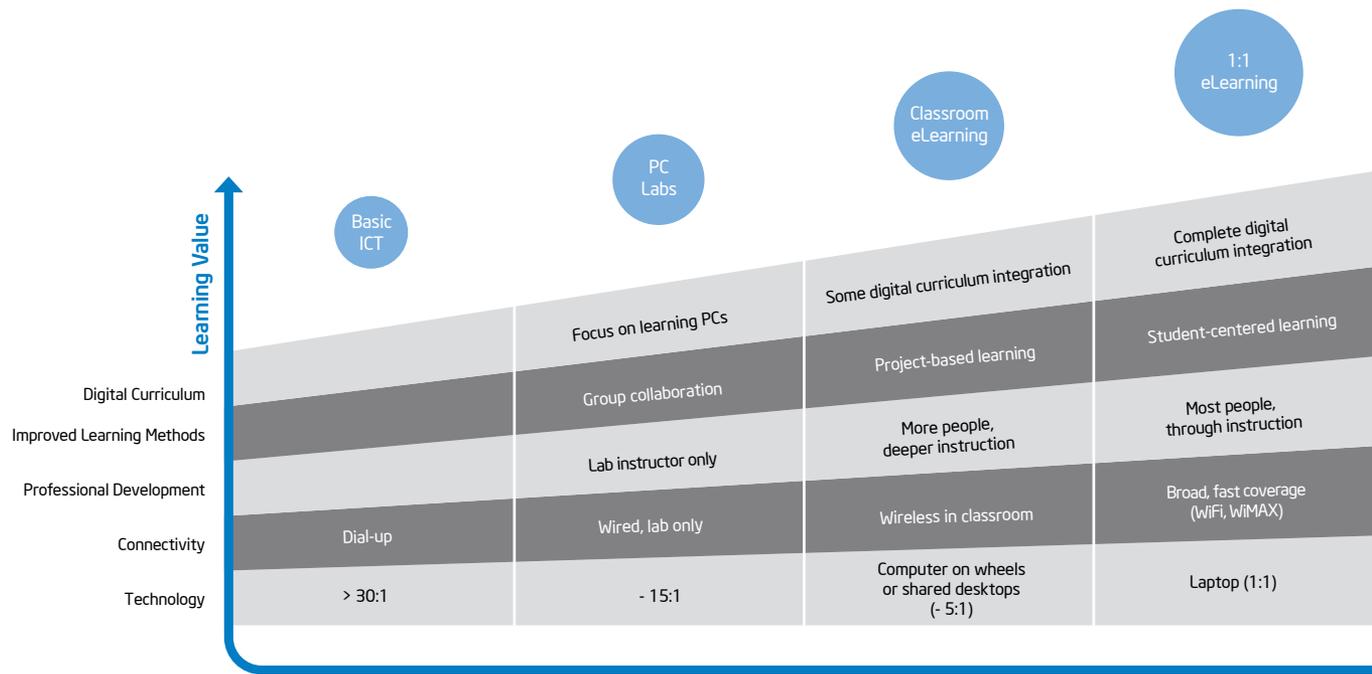
Bringing Technology into the Classroom

Classroom eLearning provides a more flexible, cost-effective, and educationally powerful alternative to PC labs. Accompanied by effective professional development and curriculum resources, classroom eLearning makes technology a normal part of the educational experience rather than an isolated activity conducted in a separate room. The focus shifts from technology-skills acquisition, to using technology as a tool to transform teaching and learning in the classroom.

While classroom eLearning can be as simple as a few desktop PCs stationed in one area of the room, the more powerful model involves mobile carts (COWs). These carts, holding multiple PCs, are brought into the classroom, and students are able to use a dedicated device for part of the day. Figure 2 shows the typical elements of a classroom eLearning environment.

They include:

- **Student mobile PCs.** Student devices must be lightweight but sturdy, suitable for the targeted age range, and powerful enough so students can experience the Internet and interact with media-rich educational software. For upper grades, laptops based on the Intel® Core™2 processor are recommended to provide the necessary performance and headroom, as well as an appropriately-sized screen and keyboard. Child-friendly, Intel-powered classmate PCs, part of the Intel® Learning Series, are recommended for younger students.
- **A full-featured laptop for each teacher.** Teachers use their laptops to explore new curriculum resources, develop and deliver lesson plans, and perform administrative tasks. To enhance teachers' productivity and increase their effective use of technology, each teacher should have an Intel Core 2 processor-powered PC.



eLearning Environments

Figure 1. The more advanced the learning environment, the greater the learning value. Classroom eLearning provides significant educational and financial benefits over PC labs while helping schools move toward full 1:1 eLearning.

- **Internet access.** Students need connectivity to access the wealth of resources on the Internet, connect and communicate with students around the world, e-mail and chat electronically with their teachers during and after class, and share the results of their work. Robust, school-wide wireless networks give students and teachers the flexibility to use technology in their classrooms, school libraries, study halls, and other areas.
- **Mobile cart.** A variety of mobile carts or trolleys are optimized for educational uses. The cart holds the mobile PCs. It may also provide security locks, wireless access points, battery chargers and extra batteries, and printers. Specialized carts may include equipment such as digital microscopes and probes along with the laptops, so students can conduct experiments and analyze, graph, and report the results on their computers.
- **Interactive whiteboard.** A digital whiteboard offers an efficient, engaging way for teachers to introduce new topics and present whole-group lessons, and for students to share what they have learned.
- **Classroom management software.** Teachers use management software to administer exams and to monitor and chat electronically with students as they work.

Educational Benefits of Classroom eLearning

Any technology investment returns greater value when the technologies are used more frequently and effectively. In addition, technology's educational impact also increases as technology is more deeply integrated into the educational experience. Classroom eLearning—along with professional development and digital curriculum resources—facilitates this integration. It allows technology to become a practical tool for teaching reading, writing, science, math, social studies, and other core subjects. Students develop computer skills—and much more—as they use technology to conduct research, read and analyze a wide range of materials, create

reports and presentations showing what they've learned, and publish their results. They become active learners and producers of knowledge, not passive recipients, and they develop the skills and attitudes necessary for success in a 21st century, knowledge-based economy.

Since students don't have to leave the classroom to go to a technology lab, classroom eLearning makes more time available for instruction and learning, further contributing to the educational value.

A growing body of research supports the educational impact of classroom eLearning. InfoDev and the World Bank reviewed studies that examined ICT's benefit for education in developing nations. They found that placing PCs in classrooms rather than in separate labs enabled greater use of technology for higher order skills.¹ In West Virginia, a US state with a low per capita income, students who experienced classroom eLearning had higher gains in overall scores and in math scores than those whose only technology access was in computer labs.²

Developing 1:1 Expertise

Classroom eLearning, accompanied by relevant curriculum materials and professional development, moves schools toward full 1:1 eLearning. It allows students and teachers to experience the benefits of increased technology access, while enabling policymakers, administrators, and teachers to develop the expertise, skills, and confidence needed for successful adoption of 1:1 eLearning. The West Virginia study showed that teachers in a classroom eLearning environment became more confident in their technology skills. The British Journal of Educational Technology reported similar findings from a study of four fifth-grade classrooms that shared two 15-computer COWs.³ Teachers and students used technology more proficiently and more often as the school year went on. They also engaged in more project-based learning, and teachers acted more frequently as coaches or facilitators.

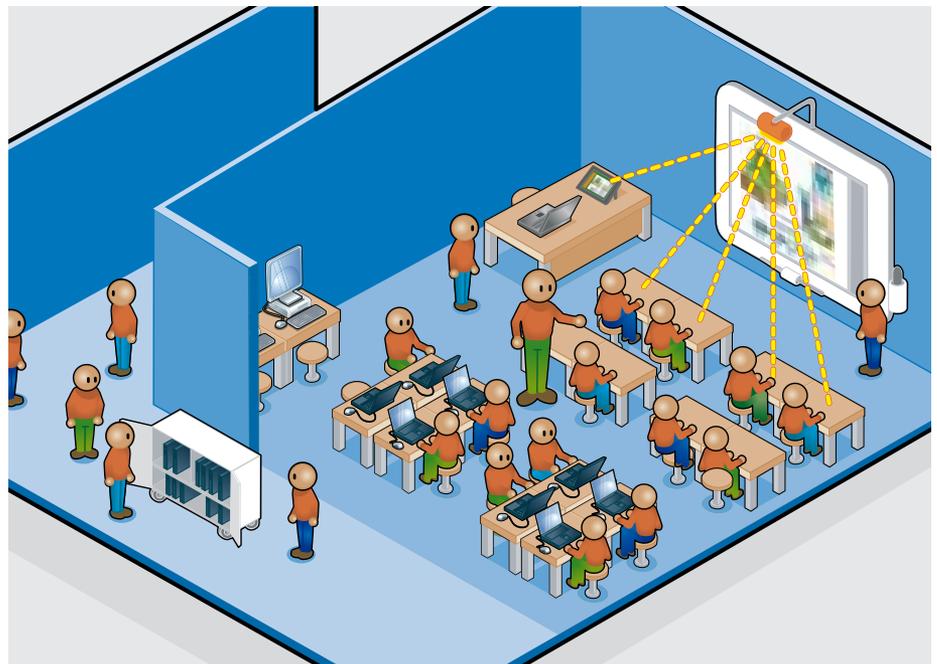


Figure 2. Technologies for classroom eLearning. In a 21st century learning environment, teachers facilitate learning rather than just dispense information. Laptops are used for individual and small-group work, and an interactive whiteboard for whole-group lessons and sharing of student projects.



Teachers who have technology in their classrooms and are provided with a personal laptop spend more time using technology to develop and deliver project-based lessons that leverage technology, as well as to manage their administrative workloads more efficiently.

Financial Impact

In addition to pedagogical benefits, several analyses show that classroom eLearning is more cost-effective than PC labs. Wireless networks can generate significant savings compared to the hard-wired networking for a traditional computer lab. COWs can eliminate the need for a dedicated room with additional desks, electrical retrofitting, and other infrastructure. Since space is almost always at a premium, COWs provide additional value by freeing classrooms for other use.

Table 1 compares the costs of a COW implementation with 30 laptops and a computer lab with 30 desktop PCs.

Table 1 does not include costs such as school servers and professional development that are standard across both environments. It does take account of variable costs relating to devices, networking, electricity, physical security, furniture, setup, and replacement parts. Since school systems generally buy extra units to have in case of maintenance or loss, those costs are included as well.

The financial model does not include theft deterrence, which is a necessary part of both lab and COW environments. Effective theft deterrence combines:

- **Technologies**, such as locking-devices that tether mobile computers to the cart when not in use
- **Education**, such as teaching students how to avoid theft if mobile PCs are used outside the classroom
- **Practices**, such as theft checks

In addition, community involvement in eLearning can help create a social stigma against theft and vandalism. School systems may also want to investigate purchasing theft insurance. Above all, school systems should keep in mind that the educational benefits of mobile PCs far outweigh the cost of insuring them.

In an earlier report on four eLearning deployments, research firm IDC found that classroom eLearning saved an average of 70 percent over a 10-year period and 60 percent over 15 years compared to traditional PC labs.⁵ The largest single source of savings came from eliminating the dedicated classrooms needed for PC labs.

Table 1. Comparing the Costs of COWs and Desktop PC Labs

| | COMPUTERS ON WHEELS | DESKTOP PC LABS |
|---|--|---|
| Initial acquisition costs (30 units) ⁴ | \$24,659 | \$25,516 |
| Electricity (yearly) | \$67 | \$603 |
| Variables | \$650 for laptop 6 percent of hardware cost for installation \$2,000 for infrastructure (cart, security, networking) 2 hardware spares for 30 units | \$450 for desktop 8 percent of hardware cost for installation \$10,000 for infrastructure (furniture, security, networking, electrical retrofitting) 1 hardware spare for 30 units |

Supporting Transformation Strategies

Many nations are using classroom eLearning as part of comprehensive efforts to modernize their education systems and prepare their students—and their country—to meet the challenges of the 21st century. Here are snapshots from around the world:



France. Following successful pilot projects conducted with assistance from the Intel World Ahead Program, the French Ministry of Education has announced a EUR 50 million stimulus program that will establish classroom eLearning at over 5,000 rural schools. Digital classrooms will include wireless connectivity, COWs with full-featured laptop PCs, interactive whiteboards, and multimedia content. Many French teachers are participating in Intel® Teach Advanced Online through the French Ministry of Education. Intel Teach Advanced Online is a professional-development community to further the use of best-known practices for effective technology use in education.



People's Republic of China. Schools all over China will be using more than 10,000 COWs by end of this year to expand educational opportunities. New deployments using classmate PCs powered by the Intel® Atom™ processor and manufactured by local OEMs, are helping to expand the nation's technology ecosystem. In a recent implementation of classroom eLearning in Dong Guan, part of the Pearl River Delta in China's Guang Dong province, Dong Guan Telecom acted as a system integrator for the project.



Russia (Siberia). In the remote town of Iskitim in the Novosibirsk region of Siberia, two primary schools are using COWs to expand educational and economic opportunities. Aquarius, a Russian IT company, provided a localized COW solution. Along with using technology to learn more effectively, Iskitim students contribute to the world's knowledge by publishing reports such as an Iskitim Guide. Teachers are developing curriculum materials which they share on Letopisi.ru, an educational wiki-based project. And more than 10,000 teachers in the Novosibirsk region have completed the Intel Teach Program.



Thailand. Chulalongkorn University Demonstration Elementary School worked with the Intel

World Ahead Program to establish a classroom eLearning environment that included mobile computers. The four-month test deployment produced significant improvements in the teaching and learning processes, with students more motivated to participate in the learning process. The project provides a model for other schools in Thailand to replicate.



U.S. (Washington Parish, Louisiana). In one of the most economically dis-

tressed regions of the US, students with learning disabilities are experiencing classroom eLearning that includes powerful Intel® processor-based laptops as well as interactive whiteboards and digital camcorders. Teachers say this technology helps them meet each child's needs, and the program is so successful that non-disabled students want to be part of it.



“We’re not buying many desktop PCs any more. They’re obsolete except for in the office. The days of marching kids to a separate room are dwindling—it makes much more sense to bring the technology to the kids.”

Dr. Pamela Williford
 Director of Special Education
 Washington Parish School System

Promoting Success

Today's students must develop 21st century skills if they are to thrive in tomorrow's world. Classroom eLearning is a cost-effective way to help them develop those skills while moving the school system toward the power of full 1:1 eLearning.

The Intel World Ahead Program works with governments to develop eLearning programs that help improve teaching and learning around the world. These programs bring together critical solution elements: improved learning methods, technology, connectivity, teacher professional development, and localized digital content. Intel also creates effective public/private partnerships to help governments develop successful eLearning programs.

What is your vision of the world ahead? Contact your Intel representative to put together a comprehensive plan for using educational technology to help make your vision a reality.

For more information, visit www.intel.com/worldahead

Intel has prepared an eLearning Deployment Guide to assist organizations preparing for eLearning adoption. Download the guide at:
http://download.intel.com/intel/worldahead/pdf/Intel_eLearning_Deployment_Guide_fin.pdf

¹ Michael Trucano, Knowledge Maps: ICT in Education, InfoDev/World Bank, 2005.

² Dale Mann et al, West Virginia Story: Achievement Gains from a Statewide Comprehensive Instructional Technology Program, Milken Family Foundation, 1999.

³ Michael M. Grant et al, Computers on Wheels: An Alternative to "Each One Has One," British Journal of Educational Technology, Vol. 36 No. 6, 2005.

⁴ Vital Wave Consulting, "Affordable Computing for Schools in Developing Countries," June 2008, http://www.vitalwaveconsulting.com/pdf/Affordable_Computing_June08.pdf

⁵ The Cost Benefit of Mobile Computing: Case Studies in Education, IDC, 2002. http://dell4hied.com/offers/article_107.pdf?actid=66260

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