



THE COMPUTERWORLD HONORS PROGRAM

CASE STUDY

LOCATION:
*St. Louis, Missouri,
United States*

YEAR:
2006

STATUS:
Laureate

CATEGORY:
Education and Academia

NOMINATING COMPANY:
IBM Corporation

ORGANIZATION:

Whitfield School

PROJECT NAME:

Linux Laptop 1 to 1 Program

Summary

In recent years, K-12 schools have been integrating laptop technology ubiquitously within their curricula to prepare students to be competitive in college and the global economy. Unfortunately, consistently shrinking budgets present public and private schools alike with funding and sustainability issues. Thus, laptop programs are quickly becoming the domain of our nation's wealthiest private schools. This type of advantage furthers the digital divide, ensuring the highest levels of technological fluency for only a small percentage of the population. Whitfield School successfully piloted and is expanding and sharing a unique model of 1:1 computing (each student having his or her own computer) which is significantly more affordable and sustainable in an effort to narrow this new digital divide. As a result, educational institutions facing budget concerns now have a model of computing that provides students the tools to dramatically enhance their educational capabilities.

Introductory Overview

Ubiquitous computing programs, which provide a computer per person, can have a revolutionary impact in the classroom. Some of the most significant changes can be that a personal laptop:

- Empowers students to be content creators rather than content receivers.
- Increases opportunities for experience-based (versus information-based) education.
- Teaches students in the medium of their time.
- Increases students' technology literacy.
- Significantly expands available resources.

Much of the research on 1:1 programs reinforces the idea that students participating in these programs take more ownership of their work, spend more time on task, and have higher technological literacy. Some programs have even found increased scores on standardized tests. For a thorough discussion of the impact of laptop programs see "Learning with Technology: The Impact of Laptop Use on Student Achievement," *The Journal of Technology, Learning, and*



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Assessment, January 2005.

However, these programs can be expensive to start and maintain. Recently, statewide programs, such as those in Indiana and Michigan have been modified or eliminated due to funding issues. Whitfield School has observed and learned from the experience of those employing laptop programs for many years and has attempted to design a more affordable and sustainable model using Lenovo ThinkPads, Novell Linux Desktop and Citrix Presentation Server.

This combination of technologies allows for a rugged, affordable laptop which is practically immune to current spyware. Students have access to a full Microsoft Windows environment when they are connected to the Internet. When they are not connected to the Internet or choose not to work in the Microsoft Windows environment, they have access to a robust Linux operating environment with a full suite of attractive productivity and enrichment software.

This unique combination of computing environments has reduced the time computers are unavailable or unusable in class and has reduced our acquisition costs by 27%. We have observed reductions in support times, but these will be calculated in a comprehensive total cost of ownership (TCO) analysis in June 2006.

In order to widen the community of schools participating in 1:1 programs, we have begun by sharing our experiences with other schools via shared case studies, conference presentations and a blog (<http://linuxlaptops.blogspot.com>). Also, to help us engage and encourage other schools to provide this opportunity to a wider population, Intel, Lenovo and IBM are funding a large study of our pilot. The baseline data is already available on the blog and concluding documents will become available in July 2006.

Benefits

Most importantly, our project has been professionally embraced by our faculty and students. In a mid-year assessment, 96% of the faculty and 92% of the students reported that the laptops help students take their learning to a higher level. The 1:1 access has allowed for greater use of existing resources and for the use of outside resources previously unknown. Over 85% of students report they are interacting with people beyond the immediate Whitfield community for their schoolwork.

Students are also using the opportunity to improve collaborative problem-solving skills. Over 75% of our faculty and 66% of our students report observing students coaching other students "often." Students are reporting that they use the laptops to communicate, collaborate and develop class projects. Faculty and students are also reporting that the caliber of work is improving as a result of laptop accessibility.

Another benefit is the introduction of open source technology. It was unknown how much time students would spend in the open source Linux environment when we began the program. It was estimated that they would spend 80%-90% of their time in the familiar Microsoft Windows environment. However, students are reporting that they spend 60% of their computer time in the Linux environment using open source software such as Open Office, Evolution (e-mail) and Firefox (Web browsing). This has exposed them to another world of software and has even inspired some of them to collaborate with open source software developers in other countries.

Our hope is that this project can give comfort and confidence to school districts which may be



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less familiar with the free or low-cost open source software and consider this as a viable option to help them improve technology access for their students. We are developing detailed cost comparisons which we share with others via conferences and our blog site to encourage schools to provide 1:1 technology for their students. We are even evaluating options to host the Microsoft Windows environment for other schools as a means to provide them a low-cost transition into adopting a similar 1:1 model in their own districts.

Our program may also serve as a template for those seeking to implement the famed \$100 laptop (from the One Laptop per Child program) into their environment. That device would fit nicely into our program as its software is effectively the same as that used in our ThinkPads. However, our program also provides experience with software and infrastructure options that can be used to expand and enhance the \$100 laptop device for use in the classroom.

The Importance of Technology

Beyond the cost of acquisition, one of the greatest costs associated with laptops used by students is combating the effects of spyware and adware. Students, in the exploration of their interests, are a primary target for spyware and adware. The unwanted installation of this software gradually diminishes student productivity, making classroom integration more difficult.

Linux effectively eliminates this problem. The design of the operating system makes it less vulnerable to these attacks. Also, this is still a bit of a “Golden Era” for Linux as it is also not the target of many of these attacks. Though this will likely change in the future, it is still preferable to the status quo as the Linux operating system allows for a better blend of access and security than current Microsoft Windows operating systems.

The use of Linux has two common criticisms. One of the common criticisms of introducing Linux in an academic environment is that students are not being prepared for the Windows world into which they will matriculate. Another is that many of the software titles used in curriculum today will not run in a Linux environment. This is where Citrix technology helps. Citrix technology allows students to run Windows programs on their Linux computer through a Web browser. They can make their computer look and perform as though it is a Microsoft Windows computer and run any Windows application. This gives them the experience they may need in college and the work world. This also allows for existing software licenses to be applied for classroom use.

Originality

Though a growing number of schools offer 1:1 laptop programs and a small number of schools use Linux, we are aware of no other school offering a 1:1 Linux laptop program. However, our use of Linux and Citrix is more than the rearranging of existing programs. This model addresses many of the concerns that have slowed the adoption of Linux in the past. We have also experienced greater per unit cost effectiveness than any other advancement since the introduction of school laptop programs. Most importantly, we believe this offers organizations greater student benefits than in the past by maintaining all current benefits of laptop programs and adding the engaging collaboration of the open source community.

Whitfield’s program is the first to wed the advantages of Linux and Citrix to the pedagogical power of 1:1 computing in education. This completely changes the existing financial and



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implementation models currently being used to develop these programs.

Success

Beyond the quantitative data discussed in the next response, we asked faculty and students to provide written feedback regarding the program. We gathered several constructive comments, which we either used to improve our program or to refer to manufacturers for improvements. Some of our students' comments were included in our participation of Novell's beta program for their next Linux desktop. Each of their suggestions will be included in the next release of Novell Linux Desktop. Some of the comments reflective of the success of the program are listed below:

"Working within the Linux environment is great. I love using all the different workspaces so I never have to minimize anything. I am a huge FireFox fan as well. I have just become very comfortable in this environment."

"The students have taken learning to a new level. Several of them take notes more efficiently with the laptops, and they are able to pull outside sources to dive deeper into the materials they are being taught. They also have another responsibility to look after, which helps them to learn to make choices for better or for worse, which is part of growing up."

"I like the fact that students can be in communication with me through e-mail. I like that I can post lecture outlines and information to my Web site which allows students access even when they miss class or lose an assignment sheet. I also like that we can easily look up information online--classes can be more organic and flexible with the laptops."

The introduction of a major change is difficult in the classroom. It is commonly understood that major educational reforms take three to five years to take hold in a school's culture. Providing students with such a powerful tool can feel threatening to a teacher accustomed to being the center of all activities in the classroom. Given that our program began so recently, in August 2005, Whitfield School has responded with amazing results. While teachers are still struggling with the delicate balance of when to let students take the lead in class, they already appreciate the current and future value of this program. Over 96% of teachers report the program is consistent with our technology plan mission. Also, despite its recent implementation, over half of the school population agrees that the 1:1 program is already consistent with or meeting our programmatic goals. Below is a list of our program goals and the results of a mid-year assessment.

Mission Statement:

We believe that Whitfield School is a world-class institution which trains students to be leaders in a rapidly changing, global community. Thus, it is our mission to provide members of our community with the appropriate tools and experiences to create leaders in such an environment.

96% Agreement of achievement

Goals:

Develop and maintain a flexible and reliable network which serves as a fluid and natural extension of the curriculum and pedagogy of the school.

84% Agreement of achievement *



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Commit to activities which foster inquiry and enhance problem-solving skills by developing information literacy capable of adapting to new research technologies.

65% Agreement of achievement *

Create an environment of systemic professional development, which fosters initiative and develops a community of learners to elevate the value of technological tools.

56% Agreement of achievement *

Seek opportunities to use technology to access diverse resources and communities as a means to participate in a wider community of learners.

79% Agreement of achievement *

Develop and foster an environment which seeks active communication within the school community to hear and develop responses to technological needs.

70% Agreement of achievement *

Maintain a secure digital environment for students while allowing students the freedom and privilege of making responsible choices.

81% Agreement of achievement *

* These percentages reflect the average of several survey questions.

Difficulty

This project faced two major internal obstacles. The first was effectively communicating and financially justifying exactly what our program was, given that none like it had been created before. Our president and the Board of Trustees needed help understanding how this model would function. This obstacle is discussed in the next section. The second major internal obstacle was a learning curve that pushed us significantly further than we anticipated needing to go, due to the unexpected popularity of Linux among students.

We had anticipated that students would spend 80%-90% of their time in the Windows environment, given their experience and comfort level. Given this, we spent more time teaching our students and faculty how to get their computers functioning in the Windows environment through Citrix. We only gave faculty and students a brief orientation to the open source programs on the Linux environment. Our intent was to slowly integrate these tools and mitigate the impact of change. Our students had a different plan in mind.

As noted earlier, students spend 60% of their time in the Linux environment, using the open source tools. Our teachers, wanting to be consistent with “teaching students with the tool of their time,” became overwhelmed. Integrating this new tool into the curriculum and trying to troubleshoot a new operating system proved to be difficult. Also, though students had been given laptops with only Linux (Windows only available through Citrix), teachers were given computers that could boot into either Windows or Linux. Again, this was done to mitigate the impact of change. Unfortunately, this created a culture clash of students choosing to “live” in Linux and faculty choosing the “live” in Windows.

The challenge detailed in the previous paragraph took some time to work out. Our first step was to help teachers feel comfortable asking students to work in Windows through Citrix if



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lessons were designed to run in Windows. A few successes with this strategy put people on common ground and took some pressure off the teachers. The students responded very well. After this, some of the more skilled teachers encouraged students wanting to work in Linux to do so but at their own risk. It was the intent of the teachers to develop little learning communities where students would become troubleshooters for one another. With time this occurred and contributed greatly to the suggestions mentioned above, which were used in the Novell beta program. We now have a hybrid environment with students and teachers spending time in both Linux and Windows. Students still spend more time in Linux and teachers still spend more time in Windows.

This conversation was a fruitful one, however, and has led to a decision to move teachers to the same Linux environment as the students. Teacher machines will boot into both Linux and Windows for one more year. After that, all academic computers will boot exclusively into Linux. Windows will remain available through Citrix.

Though the program is running more smoothly now, we still need to work vigilantly to improve our user satisfaction and increase agreement with achievement of our goals above. Our criterion for success is to have at least 85% average agreement in all goal areas.

Beyond the internal obstacles, we have one major external obstacle. Part of the intent of this program is to increase the overall participation of schools in 1:1 programs. We need to get the word out and do what we can to help other schools, districts and states begin 1:1 programs that fit their needs. Perhaps they will implement their programs differently than we, but we want them to know of their options, which now include this new and more affordable approach.

Our program model idea germinated about two years before release. It started as a plan for "thin" laptops receiving almost all of their functionality from the network. However, resistance from our teachers and students forced us to rethink the environment. Another factor was that we did not achieve the desired savings with this model. At the time, Linux merely served to patch the existing hole in our plan. This left us with the need to convince our Board that we should use Citrix and Linux technology as part of our 1:1 plan. Neither of these technologies was familiar to our Board.

We completed extensive research on what we believed this model would cost and had good benchmark data. Our president and technology director shared this information with several key influencers on the Board before presentation to the full Board. Then, while showing them the comparative value of our model with tables and line graphs, we demonstrated a prototype wireless laptop with Linux running in one workspace and Windows running on another workspace via Citrix. We used the same principles with which we teach our students; tell them, show them, then let them experience it. The early resistance in our individualized meetings helped us shape our program model and improve our message so that the full Board presentation went smoothly.