

Reflections of a 1 to 1 Laptop Program: Lessons Learned

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Abstract: This program is designed and implemented in order to enhance student learning and achievement. This paper is a report on the various stages of a 1 to 1 laptop program as instituted at Toledo Central Catholic High School. This paper will detail the reasons for the program, the planning stages, infrastructure design, hardware selection, software selection, the implementation process, and the lessons learned during years 1 to 3.

Background

Central Catholic High School, located in Toledo, Ohio, has been forward-looking and studying trends in educational technology for many years. The idea of implementing a laptop program was simply an evolution of thought leading in a direction that would provide all of our students with equal and common opportunities in education. The 21st century requires that our learners be able to navigate smoothly, effectively, and purposefully through the world of technology. "Technology is a powerful tool with enormous potential for paving high-speed highways from outdated educational systems to systems capable of providing learning opportunities for all, to better serve the needs of 21st century work, communications, learning, and life" (Petzke & Lopez, 2010).

Since a Long Range Strategic Planning Convocation that took place in the spring of 2005, Central Catholic High School has made great strides toward achieving all five of the primary objectives that were identified as major educational technology priorities. The objectives are ranked below in their order of importance relative to the success of the program:

1. Hire full time support personnel that will provide immediate support to any and all technology based needs.
2. Establish a technology center in order to provide full support of these objectives.
3. Fully integrate educational technology into every curricular area.
4. Provide all students and staff with laptop technology capabilities.
5. Make academic administrative functions paperless.

In the spring of 2005, Central Catholic High School hired a new Director of Curriculum and Director of Technology. These two individuals collaborated quickly and effectively to lay a foundation that would provide Central Catholic the ability to rapidly adopt and integrate technology into the school educational environment. 2005 also marked the distribution of a laptop computer into the hands of each faculty member in our school. Professional development was provided to help faculty members more easily adapt the computer into their classroom and

curriculum.

In the March of 2006, CCHS hired an individual with a degree in computer science to be the lead technician in the Technology Resources office. Aside from basic IT service and support, this staff member is also responsible for supporting any and all web-based services at the school. This hire completed the development of a school technology center that could now provide customized, rich and diverse services and support to all facets of the school community.

During the fall of 2006, Central Catholic announced our One Connected Community program. Part of this announcement informed our stakeholders that beginning with the class of 2007, each subsequent incoming freshman class would be given laptops and would take part in our 1 to 1 laptop program. After 4 years, all four-grade levels would have laptops and the entire school would be participating in the program. One of the goals of this laptop program is improved student performance. According to a study by Rockman et al, students who participate in one to one learning turn out to be better writers, collaborate more effectively and are more willing and dedicated participants in their curriculum. ("A Complete Guide to One-to-One Computing in the K-12 Environment," 2008)

The second goal of One Connected Community is to develop an effective model for project-based instruction. The new standards for the integration of technology point to a project-based learning environment in the classroom (State of Ohio Technology Course of Study). By shifting technology instruction into subject area classrooms, our students will develop skills required to be self directed, independent, and lifelong learners.

According to a study conducted and published by Adams and Burns (1999), "discussions, conversations, explanations, listening--all these are ways we learn by interacting with others. Project-based activities encourage social interaction and introduce multiple perspectives through reflection, collaboration, negotiation, and shared meaning. In many situations, learning is enhanced by verbal representation of thoughts--it helps to speak about an idea, to clarify procedures, or float a theory to an audience. The exchange of different perceptions between learners enriches an individual's insight" ([Ennis & Mocanu, 2004](#)). These laptops provide the students with a multimedia creation platform that is exceptionally suited to project-based learning.

Planning

Throughout the 2006-2007 school year, the Director of Curriculum, Director of Technology, as well as the Principal of Central Catholic traveled around the midwest to various schools, vendor events, and technology conferences. Knowledge gained from these visits helped us to focus our plans for our 1 to 1 laptop initiative. During this same time period, a "change team" was formed consisting of faculty, administration, and our media specialist/librarian. The purpose of the team was to set goals and plan strategies for integrating laptops and technology into classroom curriculum.

Lastly, our Technology Resources department began to investigate computer platform choice, laptop model and laptop case selection, the technical and logistical aspects of laptop imaging, the task of assigning laptops to a specific student, laptop rollout and distribution, laptop maintenance, laptop repair, laptop insurance, and the end of year collection of laptops in order to facilitate the updating of software and assess the condition of each computer.

In order to limit the financial burden of repairs on our parents and school, each student would be required to purchase laptop insurance. The annual premium for this insurance would be \$38.00 and is included in the school's \$200.00 technology fee. Should a student damage a laptop, or one turns up missing due to loss or theft, the student is required to pay a \$250.00 insurance deductible.

After looking at the various platforms to standardize on, the decision was made to go with Apple and Mac OS X. The deciding factor was the end-user experience. The Mac OS X platform has zero viruses, is virtually impervious to malware, has an integrated multimedia suite of applications installed on it out-of-the-box, and runs on UNIX. The robustness and security of UNIX is derived from 41 years of development. UNIX was first created in 1969, and has since been refined into a number of fine operating systems. Mac OS X is one of those. Taking all of these advantages into account, we decided that our laptops and servers would all be running Mac OS X and Mac OS X server.

We planned on purchasing two new servers for year 1 of our program. The first server would take over duties of network authentication from an older server, and the second would contain all of the student portable home directories that each laptop would sync its user documents to. The backup of these documents would work in this manner: each laptop would sync all of its user documents to the portable home directory server, and each portable home directory server would copy changed or new contents to an external FireWire drive on a regular basis. We would do a fresh clone of these servers once a quarter to additional FireWire drives and move those drives offsite for safe keeping.

Infrastructure

Back in 2005, an assessment was done to determine the viability of the technology infrastructure in place at Central Catholic. It was determined that the entire infrastructure should eventually be completely replaced. The wired and wireless networks should be designed and installed by professionals, and all of our existing file sharing and authentication servers should be replaced with more robust and cost effective solutions.

The wired infrastructure was upgraded in phases. The first phase specifically centered around the network backbone. New switches were brought in with gigabit uplinks between them. New cable was pulled between all of the switches. Once the backbone was upgraded, work began on pulling new cable to all of the locations where wireless access points would be hung. A site survey was completed to determine these locations. The last phase of the upgrades consisted of new data cabling being pulled to every classroom. Two cables were pulled to each classroom. The first was used for data coming from teacher laptops, and the second was used for telephone.

Since the amount of computers on our network would be more than quadrupling as a result of the One Connected Community program, our internet connection was upgraded from dual T1s at 3 Mbps to 100 Mbps Ethernet.

At the time we installed our new wireless network, the current standard was 802.11g. We were aware that some vendors were selling 802.11n hardware prior to it being confirmed as a standard. Site visits to other 1 to 1 initiatives impressed upon us the need for maximum bandwidth availability in those environments. We decided to commit to using Apple Airport Extreme N access points. In doing so, we saved many thousands of dollars over an enterprise-class network, and were able to provide 802.11n to our laptops. Enterprise-class vendors did not have 802.11n wireless access points available during this time period.

In 2006, Central Catholic implemented a web-based school information system, PowerSchool, and a web-based course management system, Moodle. Having these two systems in place created an educational environment ideally suited for 1 to 1 computing.

Hardware/Software Selection

In determining which laptops to use with our 1 to 1 initiative, the deciding factor was again, the end-user experience. Macintosh computers ship with Apple's iLife suite of multimedia applications. iLife is unmatched on any other computer platform. Photos are imported into iPhoto, video is imported into iMovie, music is imported into iTunes, soundtracks are created in GarageBand, and audio/podcasts are recorded into GarageBand as well. Once this is accomplished, this entire media library is quickly accessible to each iLife application directly from within that application. GarageBand has integrated access to movies, music clips, and photos that are being managed by iMovie, iTunes, and iPhoto. iMovie has integrated access to music and photos that are stored in iTunes and iPhoto. This suite of elegantly designed applications is exceptionally suited to the project-based learning that our 1 to 1 initiative would focus on.

An office productivity suite had to be chosen. In order to maximize compatibility with Microsoft Office and limit the impact to our technology budgets, we chose to standardize on Open Office. Open Office is a free, open source program created by programmers all over the world that donates their time to the Open Office project. It can both read and write Microsoft Office file formats.

A number of free and open source software applications were installed onto our laptop image. These applications provide a plethora of functionality to our laptops. A complete list of these applications is available at: <http://www.chrishamady.com/journal/2009/7/14/free-apps-for-1-to-1-macbook-image.html>

When our school first looked at 1 to 1 computing, we inadvertently thought that we would be doing away with computer labs. While we were able to remove our general computing "open" labs from the school, we still have a number of special purpose computer labs that run specific applications. There are a number of reasons for doing this. In some cases, site licenses either do not exist, or are cost prohibitive, while some software might require USB hardware dongle authentication. Another issue is one of hardware resources. Certain software, like Apple's Final Cut Studio Pro, requires high-end workstations in order for the end-user to have access to all of the functionality contained within the software's feature set. In any of these cases we cannot purchase site licenses for the laptops. We continue to support one or two labs in our building specifically purposed for the students to be able to work on that specialized software.

Implementation

As mentioned previously, faculty professional development began during the period of time when the faculty first received their laptops (spring/summer of 2005). Most of this professional development centered around general use of the laptops such as email, web browsing, intranet usage, and specific use of online resources. Once the decision was made to move to a 1 to 1 environment and put MacBooks into the hands of our students, more specific professional development was done with more of a focus on curriculum integration. A number of presenters from Apple Inc. were brought in to teach our faculty how Apple's iLife software can be used to implement project-based learning (spring/summer 2007). We also utilized our attendance at technology conferences to scout for presenters that we felt would provide our faculty with high quality professional development. These presenters were brought into the school and did an excellent job.

Beginning in spring of 2007 and taking place throughout the summer, a wireless site survey was done, cable was pulled to all of the locations designated by the site survey, and wireless access points were installed. All of this was done prior to the imaging of the laptops.

Laptops were imaged in early August and all software was tested thoroughly. A minor issue cropped up when it was determined that our DHCP server was not providing IP addresses to the laptops when they were connecting to the network via an WPA encrypted wireless connection. We changed the wireless encryption to WEP and that problem was resolved.

We set aside three evenings for our laptop rollout. All of the laptops were stored in a classroom behind our basketball arena. When students and their parents arrived, we verified that all paperwork was signed and the \$200.00 technology fee had been paid. If the paperwork was signed and the fee was paid, the students were given their laptops but not their laptop case. They were told that they must go into the arena and watch an hour-long presentation on how to properly use and care for their laptop. Apple provided a slide show presentation that we modified for our specific use. After the presentation was completed, students could go pick up their laptop case.

During freshman orientation week, each student attended (3) one-hour sessions that focused closely on laptop usage and application usage. Students were taught how to effectively navigate the operating system, use the Open Office productivity suite, and they were shown how to use Apple's iLife suite to create audio and video projects. Internet safety and acceptable use were also covered during these sessions.

Year 1

Throughout the first year, our teachers and students made great strides toward technology and curriculum integration. A big change in our students was noticed in the area of technology literacy. We were concerned that using Open Office might create a barrier to learning considering that most of the students were already accustomed to Microsoft Office. This was not the case. The students quickly and easily adapted to the new office suite and were even able to teach our faculty, as well as those in our technology resources office, many features of Open Office that we were not aware of.

Professional development continued throughout this first year via time set-aside during faculty meetings as well as teacher in-service days.

Our wireless network worked nearly flawlessly once we had alleviated the WPA/WEP DHCP issue mentioned earlier. Slowdowns of wireless network traffic were rare or non-existent. We were very satisfied with the Apple Airport Extreme N access points.

Throughout the first year, it became increasingly clear that the maintenance procedures that we had in place needed to be rethought. We were sending more and more computers out of the building for repair and it was beginning to create a logistical as well as a bookkeeping hurdle for us. By the end of the first year we decided that we needed to hire a full time laptop technician who would work toward Apple repair certification. As a result, we would attempt to do as much repair work as possible in-house. We hired a new technician during the summer of 2008.

Printing became a major issue during the first year. Initially, we did not have any controls on printing. Students were printing excessively and in some cases, content that had nothing to do with academics. We researched print control solutions and decided to implement PaperCut <http://www.papercut.com>. PaperCut gave us the ability to quota the amount of printing that each student is allowed to do. We also enabled a feature for all print jobs to show who printed them within the footer of each page via Apple's WorkGroup Management software.

During the beginning of June of 2008, we collected all of the laptops during a 20-minute session in one of our gymnasiums. We had a number of tables labeled with the initials of student last names: A-G, H-M, N-S, and T-Z.

The students brought their powered-on computer and power adapter to their respective table. Staff members quickly made a notation of any damage to the computer or power adapter on sheets of paper that listed the name of each student. Our staff then had the student initial the document acknowledging the fact that the damage was present on the computer when it was turned in.

At the conclusion of the first year, a number of parents expressed concerns about Internet content filtering. While Central Catholic did provide content filtering when the laptops were used on the school network, we left the monitoring and acceptable use of the computer up to the parents when the laptops were brought home. A very small number but vocal group of parents wanted this changed, and we reluctantly agreed to enable Apple's Internet content filter at home. Our single biggest complaint about the One Connected Community program goes back to this decision. Students and teachers complain that the computers are too "locked down," thus creating a barrier to learning. While we do have the ability to "white list" content that is academically needed and requested, all too often the lag time required to make this change seems to lead to a lessening of morale with respect to the laptop's effectiveness.

Year 2

During the summer of 2008, we hired a new laptop technician, started a student IT support class, designed and built a new laptop maintenance/storage area, imaged all of our laptops and servers with the latest Mac OS X update (Mac OS X 10.5 Leopard) on them, and installed PaperCut print management software onto a server. We also purchased an additional server to house the portable home directories for this new incoming freshman class of laptops.

The biggest problem that we encountered during this year materialized in the fact that the laptops were randomly disconnecting from our wireless network. It turned out to be a wireless driver issue with the new Mac OS X operating system. Once Apple updated the driver for the wireless hardware on the MacBooks, this issue was resolved. Situations like this can be devastating to a 1 to 1 environment. If end-users who are enthusiastic about implementing educational technology can't implement it due to malfunctioning or inconsistent technology, their attitudes and beliefs about educational technology can be adversely affected.

The new PaperCut print management software functioned flawlessly. We were, and still are, completely satisfied with this print management solution.

During the second year, we suddenly realized that our plan of backing up "all" user documents was flawed. We would need to invest tens of thousands of dollars in huge RAID storage devices if this was going to be possible. In a perfect world with unlimited funds, we would have liked to have been able to do that. We instead decided to limit which types of documents we would back up. Beginning with year 2, we would no longer be backing up music, movies, or video editing projects. Students were encouraged to purchase flash drives or external hard drives if they needed to back up those types of files.

One highlight of our second year was the ability of our technology support staff to quickly repair laptops in-house. The addition of our laptop technician and student IT support class has proven invaluable. In some cases, students can break a screen on Monday morning, pay their insurance deductible Monday afternoon, and the computer can be repaired and returned to them the next day.

Year 3

Our 3rd year began very uneventfully. We changed very little from year 2. One big change was that our previous laptop case was rather expensive so we decided to switch vendors. In doing so we saved \$15.00/case or \$4500.00. When one considers the fact that our incoming freshman class was around 300 students, it is easily seen how a small change like that can add up to big savings that can positively affect a technology budget.

We continue to focus on providing ongoing professional development for our faculty. This is one of the most important aspects of a successful 1 to 1 laptop initiative and cannot be overlooked or understated.

Toward the end of our second year, our school librarian moved to another city. She was not replaced. Her assistant took over all duties in the library. This potentially could create printing difficulties, as the library staff was responsible for sorting print jobs. We instead moved our laptop technician and IT support class into the print area. This has worked out quite well. The library is the place in our building where the students are most likely to congregate when using their laptops. Our laptop technician and support staff can provide technical support if necessary, as well as sort the print jobs as they come out of the printer.

An increase in battery failures became apparent during this year. The original batteries from year 1 were

now showing a need to be replaced. We anticipated this and made sure that we set aside money in our budgets to take care of this issue.

We have moved forward with plans to get all of our technology support staff Apple certified. In doing so, we will eventually be able to do warranty repairs on Apple products, and Apple can pay the school for those repairs.

Future Plans

We have a number of items planned for the future that we will begin to implement either over the summer of 2010, or at the beginning of the 4th year of the program. Our lead technician is in the process of designing a portal on our intranet site that will allow teachers to quickly and easily return graded work back to the students. Teachers will visit an intranet page set up for this functionality, search by student first or last name, select the student, upload the attachment, optionally add a comment, and click a button labeled, "send." This system will then email the graded document back to the student.

Apple recently removed FireWire ports from their MacBooks and stopped support for their network imaging utility, NetRestore. We are actively looking into moving to a new imaging system for our MacBooks.

We are also beginning plans on upgrading our wireless network to a new enterprise-class 802.11n solution. Our current wireless network is functioning well, but there are infrequent slow-downs with its performance, as well as an inability to manage it from a centralized management utility. An enterprise solution will increase the performance, as well as allow us to make changes to the network one time. Those changes then are distributed to all or any wireless access points that we specify. We will also be upgrading the entire school wired infrastructure to gigabit Ethernet. This will positively benefit both wired and wireless traffic, as well as give us the ability to move to voice over IP phones (VOIP) in the future.

Conclusion

Central Catholic is committed to embracing the 21st century and adapting to the challenges of state-of-the-art education. Our One Connected Community 1 to 1 laptop initiative will continue to evolve and adapt providing our students with the best educational technology tools available, tools with which they can meet these challenges head on. In this way, our students, faculty, parents, and even the world, will truly be One Connected Community.

References

Petzke, J., & Lopez, K. (2010). Instructional Technology. *Oswego Unit School District 308*, Retrieved from http://www.oswego308.org/teaching_learning/technology.aspx

A Complete Guide to One-to-One Computing in the K-12 Environment. (2008). Retrieved February 9, 2010, from http://www.one-to-oneinstitute.org/files/CDE07_Book_MPC_K12.pdf

Ennis, W., & Mocanu, S., (2004). It's About T.I.M.E.! (Technology Improving the Methods of Education) Retrieved from <http://www.techlearning.com/showArticle.php?articleID=18902862>