

Reflections on the RCDS Laptop Program After Three Years

November 2002

The following are reflections on the Rye Country Day laptop program after a little over three years of implementation. The types of questions I was asking myself when writing this were of the following nature. Why are we doing this, what is working, what isn't, what new initiatives are needed, what should we change, etc.. The "Why are we doing this?" question comes up frequently in my own mind because our laptop program is extremely high maintenance; as I suspect are most laptop programs. The planning and implementation of our laptop program is the biggest project I've taken on in my 20 years of teaching computers and being a computer coordinator. (See Appendix A for a list of the tasks involved with implementing a laptop program.)

On the next page are some basic facts about our program which help provide an understanding of the parameters within which we are working. Following that are my reflections in an outline format.

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Reflections on the RCDS Laptop Program After Three Years

Facts about the RCDS Laptop Program as of November 2002
www.rcds.rye.ny.us/rcds_laptop_program

Date Proposed: Spring 1997

Date Implementation Started: October 1999

Grades and Numbers Involved: (1999 7-10 330) (2000 7-11 420) (2001 7-12 510)

Tech Support: Currently 2 Full Time

Curricular Support: About a 3/4 time person this year

Professional Development: Most advances made over the summer. We offer stipends for curriculum development integrating technology. Curricular support person works one-on-one with faculty and does some small group training sessions.

Faculty Computers: Most faculty in the laptop grades have school supplied Wintel laptops. Some have opted to purchase laptops of their choice through a laptop subsidy program. A few opted for desktop machines. This year we are replacing 10 3.5 year old laptops with new laptop computers.

Student Computers: Approximately 350 Wintel / 150 Macintosh

Operating Systems: Windows 98, Windows ME , Windows XP, Mac Classic, and Mac OS X

Networking: 11 Mb wireless (802.11b) cards communicating with 22 Lucent WavePoint II hubs. Placement of hubs was determined by a Lucent engineer's site survey. Students supply their own wireless cards. We recommend students buy computers which have the wireless card incorporated within the computer. WavePoint Hubs are connected by Cat 5 cable to Asante switches.

Standard Load Software: Microsoft Office / FileMaker Pro 6 / Homepage / FirstClass / QuickTime

Other Software Required in Certain Grades: Geometer's Sketchpad / Inspiration

Servers used in Laptop Grades: One Appleshare 6 file server and one OS X Server (Unix) / One FirstClass server running on a G3 / Three web servers running WebStar / Various utility servers providing DHCP and DNS

Student Training on Laptops: Done in a year long 7th grade course. In the Upper School each department is responsible for covering a particular productivity application. English-word processing, Math-spreadsheets, Science-graphing, Foreign Language-databases, Humanities-web page creation, Art-painting and drawing.

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I. Why laptops?

- A. Students face a huge information integration/organization/management task. Computers are the most powerful tool we have available for working with information. Therefore, students should be provided with computers to help them with the information management tasks they face.
1. Computers don't replace existing tools like paper, pens, pencils, calculators, etc.. They supplement these tools.
 2. Computers alone don't solve the information management tasks students face. Rather computers are part of the whole milieu of student development/support/molding which exists in a school.
 3. One of the problems of a laptop connected to a network is that it can spew out information like a fire hose spews water. There is a lot of power in the flow, in both cases, and in both cases it takes time to learn how to control the power and use it effectively to solve a problem.
 4. What is accomplished with a tool will reflect the native skills of the user and the training the user has had in learning how to use the tool. In order to gain more value from computers we must make sure that students have adequate training in the tool. We need the equivalent of drivers ed except in the case of computers it must be ongoing and frequent. This needs to be done with teachers as well as students.
- B. Computers provide a virtual playground for an increasing number of knowledge domains. By a virtual playground I mean they allow for the playful (or at least relatively painless) manipulation of information. For an activity to be playful there must **not** be a significant cost to experimenting. By handling rote (or mindless) information management tasks computers significantly reduce the cost of experimentation and free the mind to deal with non-rote (or mindful) tasks. All of the virtual playgrounds described below can of course be provided on either desktop or laptop computers. What laptops can do is create an infrastructure that will allow these playgrounds to be entered into wherever and whenever needed. As computers steadily increase in power new realms and capabilities become available for virtual playground creators (software development teams). The pedagogical richness of virtual playgrounds will increase and parents and teachers will want students to spend more time in them. Most schools will not, even if it is physically possible, put a desktop computer in every classroom for every student. The logistics just don't work due to everything from classroom size to electrical outlets. If ubiquitous, or even widespread, access to virtual playgrounds is desired,

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laptops are the only viable solution.

1. Word processing is still one of the best examples of a virtual playground provided by computers. The costs of rewriting and editing become so low that much more time can easily be spent on these activities. Increasingly there are examples of the playful integration of text and images creating a synergistic effect that can potentially deepen and strengthen the intended message of a work.
2. Geometer's SketchPad is perhaps the best example of a virtual playground in mathematics education in the secondary schools. It is rapidly becoming an essential tool for teaching Geometry. Graphing programs are increasingly being used for other math courses. Mathematica is being used with increasing frequency in the advanced Calculus classes.
3. In the study of History a virtual playground is created by the much easier access to information sources of all kinds that the Internet provides. The sources of information available are going to become steadily richer over time as more institutions digitize their collections and improving computer technology allows audio and video collections to join text and image sources. The computer does very little, if anything, to help with interpretation and analysis of all this information (that remains the job of the student and teacher) but it does, by making it much easier to get to the information, make more time and effort available for thoughtful consideration. Of course, word processing and web page design, make the technical production of formal interpretations of data much easier and therefore students are more likely to modify the presentations to make them more accurate and compelling.
4. Immersive environments are generally considered the most effective way to teach foreign languages. Teachers can provide this for a brief period each day in class. Virtual foreign language playgrounds can be created on computers so that the immersive environment can be experienced multiple times a day. It is not difficult to imagine that capability might lead to significantly greater success in the acquisition of the foreign language. Such a virtual playground is provided by the LaserDisc "Le Recontre de Phillip." This groundbreaking work is likely to be frequently imitated as DVD drives bring LaserDisc sized storage capacity to a rapidly increasing percentage of new computers.

At RCDS we have already made progress, commensurate to the resources at our disposal, in the creation of immersive environments on the computer. A FileMaker database, built around the sound files accompanying the *Panorama* text and the recording of hundreds of words and phrases by a French teacher, provides a visual and aural information environment that students can "play" in.

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We have provided video clip files to students which they can watch on their computers.

We are currently developing databases in which students can listen to prerecorded dialogs and then record their responses.

5. In Science virtual playground are created in at least two distinct ways. The first is along the lines discussed above. Students can experience virtual worlds where the parameters that control natural forces and processes can be easily manipulated and the effects observed. For example, there is a computer program that allows students to build virtual bridges and then apply virtual forces to the bridge. This allows for very rapid experimentation with different designs, experimentation that would be very unlikely to occur with real models really breaking under stress tests. Real models should be built and tested but such models can be built with a much greater depth of understanding if there is first experimentation with virtual models.

The second virtual playground type is that created when computers are used with data collection probes of all types. Computers and probes do the dull and tedious work involved with data collection and students are able to focus their energies on problem solving, analysis and theory building.

6. In Art there are esthetic qualities and values to the medium of presentation itself which will always keep computers as just one of many media. The computer can provide a rich database of visual imagery as well as a new and different medium for the creation and presentation of visual images. There may well be a new burst of creativity in photography as the resolution of digital cameras continues to increase, computers develop the memory and speed to handle these images, and printer output quality rises to match that of photographic prints. Photoshop is a classic example of a computer program providing a virtual playground for the manipulation of digital images.

With laptops the computer screen itself often becomes a surface on which to present visual imagery that is esthetically appealing and meaningful to the computer's owner.

7. Music, like Art, is a subject where the method of performance is of overwhelming importance. A jazz band, choir or orchestra will find computers of very little use except perhaps as support tools in the preparation or practice stages of molding a performance. A music teacher could distribute a sound file to all the members of a group (provided they all have computers) and ask them to

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listen to, and presumably learn something from, the musical content of the file.

Computers provide a virtual playground for the production of musical scores. MIDI systems allow for easy experimentation and remove much of the drudgery from the score production process. Again, the goal is to allow energy and time to be focused on creative endeavors.

Computers also provide a new and extremely flexible platform for the playback of recorded music. As never before people can control what music they will listen to, and when and where they will do that.

8. The use of computers in Drama is very similar to Music. Drama is a subject where performance is the end goal. Computers can be of assistance to achieving this goal by presenting models to students. Drama teachers can distribute QuickTime videos to students of particular performances, the study of which would help develop various techniques. Drama teachers can also distribute to students clips of the students' own performances which could very well help them in the development of their craft.

II. Issues with our Current Laptop Program

A. Hardware Deficiencies

First let me say what is OK with our laptops. Memory, both RAM and hard drive memory, are good. Screen resolution and brightness is good. Connectivity options are excellent. Speed of the CPUs is sufficient for all but the most demanding 3-D graphics.

Both the IBM and Apple models that we currently recommend represent what might be called 2nd generation student laptops; at least for us. Both models have the wireless card built into the computer and both have built in Ethernet ports which allows them to easily connect to wired home networks.

Both models are well built and stand up to normal student usage patterns. However neither model is as robust as we would like. Manufacturers need to do more to make laptops less vulnerable to accidental spills. Tight fitting foam cases would prevent much damage caused by small falls.

Battery life is better on the Apple laptops (3-4 when new) than the IBM models (2-3 when new) but in both cases it is too little. Batteries also steadily degrade in their ability to hold a charge. After a year battery life is 2-3 hours for the Apples and 1-2 hours for the IBMs. After two years students are lucky to have an hour of use with a fully

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charged battery. Batteries should ideally be replaced every year. An additional advantage to doing this would be that students would have a backup battery in the 2nd and 3rd years of their laptops' lives.

The laptop computer market is extremely competitive and laptops are evolving very rapidly. In the relatively near future a laptop should become available that puts all the pieces together into an ideal package. Such a package would consist of a 3-4 pound machine with a true 8 hour battery life and padding to prevent small accidents from causing significant breakage. When those specifications are achieved the major drive will be to get the price of this package down to a more affordable level. In the three years of our laptop program we have already seen major hardware improvements accompanied by significant price reductions. This trend will continue.

B. Software Deficiencies

1. Operating Systems

The latest versions of Windows and the Mac OS are significant improvements over previous versions. Windows XP and OS X have fewer configuration issues, are more stable, and have better user interfaces than their predecessors. They create computers that are easier to maintain and to use. We look forward to the day when machines running Windows 98 and Mac Classic become rare in our environment.

2. Productivity Suites

Due to Apple's failure to invest any significant resources in upgrading AppleWorks we decided to switch to Microsoft Office this year. So far the switch has gone quite smoothly. The science teachers are very happy with the switch as Excel has become the defacto standard for spreadsheets in the science education community. English teachers have been slower to move toward Word but those who have embraced it are very happy with the ability to place comments right within word processing documents. This provides a method to comment on student drafts without requiring a paper copy. It is a little early to make a determination on how well Office is working but at this point the switch is looking like a good move.

3. Other Productivity Software

a) Database

FileMaker continues to be useful as a platform for developing what are in

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essence small applications. We use it for the note taking program, the planbooks, a database of biology information, the introductory French database discussed above. This year we introduced student information systems that consist of various FileMaker databases hosted on servers. The student information system databases are very much a work in progress but we expect them to become increasingly useful, and used, as students and teachers become acquainted with this method of accessing information.

One glaring problem with FileMaker is that sounds recorded into container fields do **not** work if the database file is used on a different operating system. There are a number of foreign language teaching opportunities which would be easier to implement if this issue was resolved. We have developed work arounds but hope that in future versions of the program sounds recorded in FileMaker will be cross platform. We are currently using FileMaker 6.

b) Web Page Design

Home Page is showing its age and we will need to find a replacement as the web continues to rapidly evolve. We get Home Page free as part of purchasing FileMaker. It still works fine for simple page design but doesn't do so well for more advanced web design work. A stripped down version of Dreamweaver would be great.

c) Email

FirstClass continues to do an outstanding job for email and conferencing. It is evolving at a steady clip and currently has features, such as the calendar, which faculty and students are using at only elementary levels. The file transfer capabilities of FirstClass are excellent and it is frequently used to move files to and from students.

Recently we have begun using the web serving feature of FirstClass to split and distribute the web page management task out to faculty and staff. All faculty in the MS and US are expected to have web pages. The Alumni Office currently maintains its own pages in a FirstClass account. We are encouraging other groups within the school (such as the Athletic Department) to do the same. The great advantage of this approach is that those responsible for pages can change or update them directly from their desktops.

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d) Presentation Software

PowerPoint is part of Office. We are not actively encouraging or discouraging the use of PowerPoint. It is there for students and faculty who find appropriate uses for it.

4. Curriculum Software

Good curriculum software creates the virtual playgrounds discussed above. The best curriculum software allows students to play with the variables of a knowledge domain in a very serious way (curiously enough).

So far we are requiring students to purchase Geometer's Sketchpad and Inspiration (in some grades). Some additional math program such as TI-Interactive, Mathematica or Maple may well be required in certain grades in the future.

We are always looking for "killer apps" in the other subject areas but the more general productivity applications discussed above may prove to be more valuable than specialized curriculum software.

Another possibility is that small very focused applications may prove to be extremely valuable in certain areas. These may be traditional computer programs, Java applets, or perhaps even Flash animations.

5. QuickTime

QuickTime is quite simply an outstanding technology for dealing with audio or video files. We are using it now in the introductory French database mentioned above and have been creating video files with it. We have a QuickTime video streaming server in place and plan to make streaming files of various school activities and events. Experiments during the 2001-2002 school year established the technical feasibility of video streams. We just need to find the time to do this on a regular basis.

C. Student Training

We currently have two approaches to student training. In the middle school all 7th grade students take a year long course that meets once a cycle. In this course they receive training about how to use their computers and the basic productivity applications. In the upper school the basic productivity applications are taught/reviewed/reinforced by the various disciplines. English does word processing, math does spreadsheets, science

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does graphing, humanities does web page design, foreign languages do databases, and art does painting and drawing apps.

Curricular support software is taught to students by the teachers using it. For instance, the math teachers teach students how to use Geometer's Sketchpad.

Our middle school program achieves the goal of getting students comfortable with their computers and the software on the computers. In the upper school the effectiveness of the computer instruction depends on the commitment of the department. Departments that have had stable and strong leadership over the last 4 years have done a good job covering their assigned area of computer skills. Departments where there has been a lack of consistent strong leadership have not done as well teaching their required computer skills.

D. Furniture

Furniture is something that we have yet to adequately resolve. Part of the problem has to do with depreciation cycles. Many of the school's desks were replaced in the last three years and we don't appear ready to throw away that investment yet. We have been purchasing some wider desks and are evaluating how they work. It would be interesting to take a few classrooms and redo them to work better with laptop enabled students.

Currently the cost of doing a significant reconfiguration of a room (ceiling mounted LCD projector, smart board, cabling and electronics to connect everything) is over \$5,000. The school does not seem to be willing to invest this much money in classroom multimedia stations; so for the time being we get by with LCD projectors on carts.

E. Facilities

Our repair facility has evolved into a very effective space. We have gone through a number of configurations and now have a setup which provides the repair staff adequate works surfaces and storage space. The creation of an office for the Dir. of Info. Tech. opened up a dedicated space for servers and storage. We have long needed a better space for the production of multimedia files and that space is being created in the office area of the new middle school computer labs.

III. Common Arguments Against Laptop Programs with Replies

A. There is no good evidence of an educational benefit

The studies that are available, such as the Rockman study (financed by Microsoft), do

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show a decrease of lecture based teaching but they do not show any strong increase in student scores on standardized tests. Alan Bain of Brewster Academy (a laptop school for seven or eight years now) has recently published data showing a significant increase on standardized tests. These data are not unambiguous however because Brewster put in place a very elaborate and carefully developed set of pedagogical practices over the same time period they were integrating laptop use. Alan Bain would argue that any test score changes are much more likely due to the new pedagogical practices rather than laptop use.

What is interesting about the lack of clearly measurable educational benefits to laptop use is the almost equal lack of “hard” evidence that **any** computer use in schools is beneficial. In fact, there is considerable controversy about whether computer use in the larger society has created measurable increases in productivity.

Yet almost anyone who uses a word processor knows that the writing process is “better” than with a typewriter. However, I’m not sure anyone has developed a rubric to measure how it is better. What suffices as evidence for most people is the experience of having to retype a typewritten page because of some mistake made near the bottom of the page. Unpleasant experiences like this were a frequent occurrence when producing finished work with a typewriter. There are also horror stories about lost computer files but these losses generally occur in the novice stage of computer use before the user adopts various precautions like frequent saves and regular backups.

There is a well developed argument that the reason productivity increases have not shown up from increased computer use is that in a broad sense we as a society are in the novice stage of computer use. We know that computers definitely make many things much easier but we haven’t discovered or incorporated all the changes needed to take full benefit of what computers can do. To use the word processing analogy, we are still learning to save frequently and make backups religiously.

A strongly related argument is that we are using computers to automate the old way of doing things rather than changing what we do to take advantage of the new opportunities provided by the computer. So, for instance, we have this wonderful tool that provides the virtual playgrounds described above yet we continue to march students from class to class every 45 minutes throughout the day so that they can be placed in traditional teacher-centric classrooms. In these classrooms most students adopt a relatively passive attitude and progress is determined by the pace and method set by the teacher. This pace and method may or may not be skillfully chosen but in either case the teacher must take into account the ranges of skill and interest exhibited by the students in the class. Inevitably with this type of teaching, the pace will be too slow or too fast for some, and the method will work better with some students’ learning styles than others. For those students out of sync with the pace or the method the learning experience becomes

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suffused with anxiety or boredom, or in the worst case, some perverse amalgamation of both!

I am increasingly certain that until the tyranny of the schedule can be creatively “broken” the educational gains from using laptops will be much weaker than they would be otherwise. I’m also certain that schools will figure out ways to break free of their schedules over the next few years and that the ubiquitous presence of computers will be a necessary condition for this to happen. It is in the schools that make strong breaks with traditional practices, like Brewster Academy, that significant measurable performance improvements will start to appear.

B. The current laptop is not the ideal device

This is undoubtedly true. However it is hard to see that the ideal device will be anything other than an evolution of current laptops. A large screen is needed. A general purpose computer that can run “regular” software is needed. A keyboard is a very efficient input device once touch typing is mastered. My guess is that the trackpad on laptops will become larger and pen input will be added through using a stylus on that surface. Otherwise I think movement toward an ideal device will involve shrinking size (limited to the screen dimensions) and weight, longer battery life, more rugged components, and improved screen resolution and brightness.

C. Much learning and many subjects work best by traditional methods

Critics of laptop programs often make the mistake of assuming that laptop use is meant to replace all other teaching and learning techniques and approaches. This is nonsense. New technologies rarely replace old technologies, they instead supplement them. In a time of HDTV and the Internet, per capita book sales are probably higher than they have ever been. Laptops simply add a new tool, albeit a very powerful one, to the existing inventory of pedagogical tools educators have at their disposal.

D. For students to learn they must take notes.

Given the data that is available about the very low retention and recall rates for information learned in traditional lecture based instruction, it amazes me when this old saw is trotted out. People seem to be able to remember and recite the lyrics of songs, extensive dialogs from movie and TV shows, and entire plots of books – all without putting pen to paper.

There are certainly subjects where it seems to be easier to record information on paper than it is on computers; basically any subject with complex symbols and formulas. When note taking is required in these subjects paper is probably a better choice than

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using a computer. The larger question is should students be spending large amounts of time taking notes on paper, or on a computer, while listening to lectures? Probably not.

E. Laptops are too expensive.

Laptops are expensive and I would like the cost to drop. However, I would also like laptops that are lighter, more rugged, have longer battery life, have larger hard drives, more RAM, and better screens. My guess is that the price of the laptop that schools recommend will gradually decline but only slowly because we will keep raising the bar on what we consider an ideal machine. However, having said that, the low-end machine that we recommend has cost significantly less each year of our program. The paragraph just below was written two years ago. Currently the total cost of a laptop, with significantly better specifications than the laptop referenced below, is around \$1500.

If it is taken as a given that the cost of an ideal laptop is not likely to drop rapidly then is the current laptop cost of around \$2500 a good investment? (Note: \$2500 includes 3 years of warranty coverage, 3 years of insurance, and the basic software load.) Our assumption at RCDS is that the useful life of student laptops will be 3 years, so the cost per year works out to about \$850. This does not include the cost of in-house technical support, which at RCDS works out to be about another \$250 a year, getting us to a figure of say \$1200 a year, or \$100 a month. In the New York metropolitan area \$100 will purchase somewhere between one and two hours of tutoring from a teacher. There are obviously an infinite number of ways \$100 a month could be spent on education. However, if the choice were between a computer that provides access 24x7x365 to all the productivity tools and virtual learning playgrounds described above, or 1 to 2 hours of tutoring a month, I think the computer in most cases works out to be a much better investment. If you add to this the fact that in the everyday use of their laptops students become very proficient with a tool which will be an essential partner for most of their lives, the investment looks even better. (2000 Numbers)

If it is taken as a given that the cost of an ideal laptop is not likely to drop rapidly then is the current laptop cost of around \$1500 a good investment? (Note: \$1500 includes 3 years of warranty coverage, 3 years of insurance, and the basic software load.) Our assumption at RCDS is that the useful life of student laptops will be 3 years, so the cost per year works out to about \$500. This does not include the cost of in-house technical support, which at RCDS works out to be about another \$250 a year, getting us to a figure of say \$750 a year, or \$63 a month. In the New York metropolitan area \$63 will purchase about one hour of tutoring from a teacher. There are obviously an infinite number of ways \$63 a month could be spent on education. However, if the choice were between a computer that provides access 24x7x365 to all the productivity tools and virtual learning playgrounds described above, or 1 hour of tutoring a month, I think the computer in most cases works out to be a much better investment. If you add to this the

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F. Carrying laptops outside the school may be dangerous.

This is obviously a concern when students walk significant distances, or take public transportation, to and from the school. There are basically two ways to deal with this issue. One, teach the students not to be high profile targets. In other words, the laptops should be carried in luggage that doesn't telegraph the presence of the computer. Two, students should be educated to give up the laptop freely if someone tries to take it. That is one of the reasons you buy insurance.

Looking at this issue 3+ years into our program I see it as a classic case of a new danger being over stressed relative to existing dangers. We have not had a single instance of a student being threatened because they were carrying a laptop while during the past three years we have had the usual injuries from sports activities and minor accidents.

G. Laptops provide too many distractions in the classroom.

Having laptops in the classroom presents the student with tempting new opportunities to lose focus. These "opportunities" provide significant new variations of old classroom management issues. Teachers have always had to deal with students passing notes, doodling, day dreaming, or simply staring out the window. The new computer based variations of these classic student activities involve Instant Messaging, playing computer games, or surfing the Net. The one significant new aspect that we've been told about by students is the distracting nature of the screen content of other students' computers. If one student is playing a computer game then other students sitting behind may be distracted by the moving images on the game playing student's computer.

There are tactical and strategic solutions to classroom management issues with laptop enabled students. Tactical solutions involve practices like rearranging desks so that student screens are more visible, increased teacher movement around the classroom, having students put their screens down at certain times, and attunement to which students are paying attention. Strategic solutions involve changes in pedagogy, like decreasing the time spent lecturing and increasing the time students spend on projects.

IV. Likely Future Issues

A. Network bandwidth

With increasing use of audio and video files network bandwidth will be subject to much

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“heavier” loads. Increasing use of computers also puts stress on all the other network components. File servers need to handle larger multimedia files and more frequent use for backing up files. Email servers need to handle larger volumes of messages, many with attachments. Web servers need to handle video and audio serving as well as traditional text and image files. Our routers and DHCP server are designed for certain loads and we are already seeing issues with the DHCP server running out of addresses during peak periods of use. All of these issues are solvable provided that enough resources are made available.

Our current wireless network bandwidth (802.11b) is adequate for text and image files but starts to strain when used for transferring large audio and video files. If video streaming becomes popular this will put a further heavy load on the network. We will deal with these issues in the short term by taking a number of steps such as increasing the number of wireless cells in the network, encouraging the downloading of large files via 100 Mbit wired Ethernet, and discouraging frivolous downloading of large files. Over the long term wireless networks should move to new technologies which will provide more bandwidth.

By making adjustments to our Firewall, by ongoing education of users not to abuse the bandwidth commons, and by the use of CD-ROMs to distribute large files we have managed to avoid any major changes to our network. We will certainly move toward a faster wireless protocol when a new standard emerges. We have also been tempted by bandwidth shapers like Packeteer. However, the high cost of these products has kept us from purchasing.

B. Scheduling

I’ve already touched on scheduling above. This is a huge issue which I believe schools must revisit and rethink when they move to requiring laptops. Laptops provide the necessary infrastructure to break out of traditional scheduling and the promise of laptops won’t be fulfilled until schools take advantage of this new opportunity. As with other aspects of existing education practice, laptops don’t require that the existing scheduling practices be thrown out, rather they require the modification of those practices.

My current thinking is RCDS should start by pulling one day of our rotation cycle (we have a six day cycle) out of the schedule. On this day students would be relatively free to allocate their time to their studies as they see fit within reasonable constraints set by the school. In essence these days would provide time for students to spend extended periods in the virtual playgrounds discussed above. Academic disciplines could use this day for projects or labs that require extended time and students would have extended periods of time to really dig into projects of interest to them. Computer programs could

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easily be developed to coordinate, manage and track the available activities and the time students spend on those activities.

If after an appropriate evaluation period the above scheduling change proved to be ineffective it would be very easy to simply return the day back to the old schedule. In the more likely case that the schedule change proved to be effective then the day would remain out of the schedule and additional days could be pulled based on an ongoing evaluation of the relative benefits of the scheduled day versus the customly scheduled day.

C. Increasing computer inventory variety

The increasing variety of computer hardware and operating systems that we will need to support may become a significant issue. This year we are supporting computers running Mac OS 8.6, Mac OS 9, Mac OS X, Windows 98, Window ME, and Windows XP. This actually sounds worse than it is because our tech support staff really needs to work with only a few parts of each of these operating systems and the operating systems themselves are designed to work in heterogeneous environments.

I often use the analogy of the car and car transportation systems to help people understand the scope of our laptop program. In order for the whole car based transportation system to work you need cars (laptops), roads (networks), destinations (programs, and files on servers), driver education (computer use courses), road and traffic planning (tech coordinators), ways to handle cars at destinations (teachers moving curriculum into computer based formats), cops enforcing traffic laws (administrators enforcing acceptable use policies), and repair facilities (tech centers). Car repair facilities are able to handle a wide variety of models and model years. Computer repair facilities will develop the capabilities to handle a variety of computers and operating systems.

Schools do have an advantage in that they can mandate to their students what computers and/or operating systems are required. This control can be used to limit the computer and operating system variety a school has to manage. My expectation is that in about a year and a half we will mandate that all student laptops must be running OS X or the current Microsoft consumer operating system. What I envision is periods where the variety grows (we are in one of those periods now) punctuated by periods when consolidation is required.

D. Blurring of school/world border.

A networked laptop computer, connected to the Internet, can perform the functions of a phone, a television, a CD player, a DVD-player, and a beeper. Students can be in touch

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with the outside world, while in school, in ways that we have yet to fully grasp. With current digital technology an innovative student can already share with the outside world what is going on in their classroom.

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Appendix A

What Implementing a Laptop Program Requires From the Information Technology Coordinator

I. Creation of infrastructure

- A. Network
- B. Repair facility
- C. Classroom furniture
- D. Electrical system

II. Purchasing discussions involving hundreds of thousands of dollars

- A. Laptop platform and brand and model
- B. Printers
- C. Insurance
- D. Networking hardware
- E. Servers
- F. Software choices

III. Supervising increased staff needed for technical support and professional development

IV. Education and training of faculty

- A. Creation / nurturing of learning culture and attitude
- B. Long term perspective as many faculty move slowly
- C. Many faculty have great anxiety about their own computer use let alone helping students with the use of their laptops
- D. Incentives of all kinds are needed (money, encouragement, acknowledgment, personal attention)
- E. Sharing information with peers at other schools implementing laptop programs

V. Teaching students how to care for and use their computers

- A. Creation of new courses
- B. Workshops
- C. How do you train a large population to use a new software tool when the population isn't meeting in a course?

VI. Dealing with Parents

- A. Almost daily contact with parents regarding computer issues

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- B. In some cases contact involving significant stress due to the value of the computer and/or frustrations that computers can cause
- C. Significant ongoing need to communicate with parents via letters home or articles in school publications