Bringing Laptops to Class – The Front Lines of Curricular Computing

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ABSTRACT
It's 10:05am. Sixty students and their professor want to use network-dependent applications over a wireless network on their laptops. Forty students have file-sharing software active, thirty have spyware infested computers, and five have Nachi. Class started five minutes ago; what can you do?

This scene, and many others, played out at Drew University, where students are all issued laptops upon entry. Our faculty use technology in innovative ways, but only if it is reliable and transparent to their class. With technology-enhanced classrooms spread across campus, how do we best leverage and support the infrastructure if student computers are problematic? How do we support faculty in their pedagogical uses of our laptop program?

This year, Drew celebrates its 20th year distributing computers to students. In this paper, I will discuss the issues of supporting curricular computing in the classroom, specifically relating to laptop initiatives. This will include a review of the challenges we've encountered in helping faculty and students use these tools, as well as steps taken to overcome those challenges.

Categories and Subject Descriptors
K.3.1 [**Computer Uses in Education**]: *Collaborative learning, Computer-assisted instruction*, *Computer-managed instruction*

General Terms
Design, Reliability, Standardization.

Keywords
Technology, Classrooms, Mediated, Smart, Faculty, Laptops.

1. INTRODUCTION
Defining, supporting, and promoting curricular computing is a challenge that has no easy answer. Faculty need to understand how to teach with technology without needing to support it. They expect it to be a functional tool for their classes. Students have a broad experience with technology before they even walk onto campus, and that is growing exponentially every year. They also have a variety of perceptions of the value that technology has. Integrating those two different sets of perspectives and needs into a seamless classroom experience is a hot issue in instructional technology today.

This paper will deal with specific circumstances at Drew University, though most of the concepts and ideas are applicable elsewhere. After a brief look in computing at Drew, we will talk about the components behind the use of technology in a classroom. Within this backdrop, we can then examine the five common themes necessary to implement successful curricular computing programs.

For this paper, the phrase "curricular computing" will be used to define the use of technology in the classroom. It will be used specifically in relation to student use of computers in a classroom or lab environment.

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2. TWO DECADES OF HISTORY
In the fall semester of 1984, Drew University made the virtually unprecedented move of giving a desktop computer to each incoming freshman. In 1988, Drew switched to providing laptops instead of desktops which opened a whole new range of options to both students and faculty. This program is known as the Computer Initiative.

"The idea of every student having a computer was still very novel. Very few schools were doing this and the prior year, Drew had made its announcement making it the first Liberal Arts college to do so. CPM was a major operating system, DOS was run on our Titan cards, IBM-PCs were for the wealthy, and Macs were on the drawing board. Computers were boxes with just the basics for software. Email was unheard of by most people. Computers were the future and we were there," said Neil Clarke, Class of 1988, and former director of Drew's Academic Technology department.

Today, nearly all students have a basic understanding of how computers work. They can turn it on, log in, open applications, manage files, and use e-mail. Computers are no longer something students learn about in secondary school or college; today's students grew up with them and treat them just like a microwave or television. The vast majority of students have a cell phone, instant messaging identity, and off-campus e-mail. Students are very free and comfortable with downloading and installing software off the internet. They expect the world to be wireless.

3. TRANSPARENT TECHNOLOGY

It's impossible to discuss curricular computing without first talking about the environment in which it happens. At Drew, these learning spaces are known as Technology Enhanced Classrooms (TECs) or Mediated Classrooms. Drew currently has 27 TECs, and supporting them is one of the primary goals of our department. Making the technology transparent means that faculty should no more notice its existence or worry about its use than they should worry about a basic chalkboard. The chalkboard is a critical part of most classes, but no faculty member has to worry if it will function in a given situation, or spend class time figuring out how it works. While computers, data projectors and the like are obviously more complex, the theory is still the same. The use needs to be obvious, and the chance for failure reduced as much as possible. However, this is often more easily said than done.

The term TEC describes three different room types. The first set (see Figure 1) are designed from the outset with technology use being their primary function, and are especially reserved for that purpose. The second set (see Figure 2) are rooms that have undergone a major renovation, with technology aspects incorporated into the design and construction. The third group (see Figure 3), which is the most prevalent by far, are spaces where technology has been grafted onto traditional classrooms. All three have their uses and strong points. When looking from the perspective of a faculty member who wants students to use laptops in class and not worry about the environment, they break down into three categories.

3.1 The Good

Figure 1. Hall of Sciences 4

The best environments for curricular computing are in rooms like that shown in Figure 1. There is a large screen at the front with a powerful data projector and plenty of chalkboard space surrounding it. The computer, VCR, DVD player, and external inputs are all controlled through a single panel. The lights are automatically managed from a control panel. Each student seat has a power and 10/100baseT data port, with enough table space to comfortably use a laptop and textbook. The existing infrastructure limits the number of possible variables that could cause interruptions in a class. The controls at the front make the room easy to use for the faculty.

3.2 The Bad

Figure 2. Hall of Sciences 3

Although bad is perhaps an inaccurate term, the best phrase to describe Figure 2 might be 'sub-optimal.' While the seating is designed to give students space to spread out, there is no power readily accessible in the room and only wireless networking is available. The screen is not sized properly for the room, and the cabinet is too small to fit all the components it needs to house. There is no control system for the media. There is no granular control of the lighting and there are no shades on the windows.

3.3 The Ugly

Figure 3. Brother's College 101

The type of room shown in Figure 3 generates the most support calls by far. In this example, there can be sixty students packed into the room shoulder to shoulder. The desks barely have room for taking notes, never mind using a computer. The screen is oversized, covering nearly all of the chalkboard space. Thin shutters cover huge windows, and only through a daisy chain of power strips can students get power to their laptops. One wireless access point covers all sixty students, and the cabinet is 30% smaller than the one described in Figure 2. This classroom is often used for a class that requires students to use laptops one or two times a week. Faculty often bring in power strips and data switches just to ensure students can function for an entire class period.

3.4 Wired vs. Wireless

Connectivity is a significant issue in classroom design that affects how easy a room is to use and how reliable it is. Should the network and internet access be wired or wireless?

Wireless networking is a technology that is constantly under development. When a laptop is used in a location saturated by wireless, it can likely reach multiple wireless access points (WAPs). Will it bind to the closest WAP, the one broadcasting the strongest signal, or a different one all together? If thirty laptops are all located in close proximity, will they all bind to the same WAP, or different ones? If all thirty bind to one WAP, that's thirty computers on the equivalent of one unswitched 10baseT port. If all thirty try to access a website (such as Blackboard) simultaneously, what happens? The answer is exponential lag. What happens if it's sixty computers? Do you set up your WAPs with different network names (or SSIDs) and have different groups of students adjust their settings accordingly? Do you buy the latest and strongest 802.11b/g WAP and hope it covers everyone? Or do you bring a portable switch and create a wired connection, just in case a student is having trouble connecting? How can a professor teach with ethernet cables running everywhere?

So, it seems the obvious answer is to wire every classroom with a 10/100baseT port per seat. Well, that's a nice theory if you have the money. A dozen WAPs, in theory, can cover a dozen classrooms. Hard wiring a dozen classrooms requires much more labor, networking equipment, and cooperation from the facilities/physical plant/construction department for each and every one. It is more reliable and more robust, but significantly more expensive.

What is the right answer? Our answer is, it's both. Especially in our environment, most classes do not require large numbers of students to use laptops regularly. If enough learning spaces are set up as in Figure 1, classes that need the highest level of infrastructure will have it available and will not be stuffed into classrooms not designed to support them. Then, other classes which only require occasional use or use in smaller numbers will not be fighting for resources that simply aren't there. This decision is very relevant in helping make technology transparent by designing it for the needs of the classes instead of for the technology itself.

4. INTEGRATED SUPPORT STRUCTURES

A number of different technological infrastructures are required to support curricular computing. These support services need to be tied together, and able to respond in crisis situations, as well as to be proactive about maintenance and potential customer demands. These services not only support the users directly, but offer the basic technologies needed for mobile computing and file storage. They need to be reliable, efficient, redundant, and relatively easy to use. Support structures are not just people, but also equipment and infrastructure.

4.1 The Helpdesk

A helpdesk which fully supports the computers given to each student is a critically important support service necessary to keep curricular computing on its feet. With a reliable helpdesk, faculty can make it a course requirement that students arrive to class with a functional computer, confident in the knowledge that they have the resources available to make that happen. At Drew, the full time staff of the helpdesk is also responsible for creating the default software configurations for the student laptops. If the students' configuration is not reliable, then any support becomes infinitely more complex.

A reliable helpdesk begins the process of removing variables. If the student's laptop worked the night before at the helpdesk, chances are it is still working now. If it didn't work, and the student didn't bring it to the helpdesk, then the student has come to class unprepared. If those who support curricular computing cannot rely on the support and configurations provided by the helpdesk, then the functionality of student laptops coming into any class becomes much more variable.

Thanks to our helpdesk, every student has a laptop to work with, a printer, and no reason for them not to be in working order.

4.2 Network & File Server Backbones

All students at Drew are allotted file storage space on a cluster of servers attached to a storage area network or SAN. Every course that runs each semester also has file storage space created automatically as part of the ATTIC services.[1] With .75TB total storage available, faculty staff and students can store all their documents, create personal course or departmental web pages, and share files. Each user has a Novell eDirectory account that ties into all campus web-based services. With a single password, users can use NetWare rights to have full control over their file sharing. For example, faculty can create storage space for group projects.

"Drew's current Local Area Network (LAN) connects all campus buildings with 12-48 strands of fiber-optic cable, with runs to 4 concentration points (Brothers College, Learning Center, Pepin and Holloway). All campus buildings are currently on the network. The network backbone is Gigabit Ethernet in a multiple link, redundant meshed configuration between all main network centers. Links to campus buildings are 1Gbps or 100Mbps. All faculty and staff areas have 10/100Mbps switches in local wiring closets; student residence halls have a mix of 10Mbps shared, 100Mbps shared, and 10/100Mbps switches depending on location."[2] All academic classrooms have at least one network drop, and are covered by 802.11b wireless networking.

With these services reliable and redundant, faculty can be assured that when they need students to connect to the internet or share files, the process will be smooth and seamless.

5. CUSTOMERS & VARIABLES

"Few people would allow an untrained driver to operate their expensive new car. Similarly, few new car owners buy that car with the assumption that it would never need maintenance support. Instructional technology is basically no different. … Training is a key element to assure that implementation does not get off track. Both training and the strategic placement of training or just-in-time resource materials are not one-time events." [3]

5.1 Student & Training

All incoming students who take the First Year Experience course are required to take a computer training component in that class. These training sessions introduce students to the technology they will need to know, as well as how specific items like e-mail and the network function in Drew's environment. They will also be taught how to take care of their computers over their time at the university, and how to proactively avoid a wide variety of

hardware and software issues through proper use. The Training Resource Center also offers continuing education to the user community on a wide variety of topics, including on-site training for classes using specific software.

5.1.1 Students

Students use their laptops in a phenomenal number of ways that those who work with the technology might never imagine. More often than not, within a few days of a student receiving a new laptop, a spyware or adware scan will show numerous results. Spyware is a piece of software, browser cookie, hack or crack that allows an outside party to gather a variety of information from a computer. This is generally installed without the user's consent and, in addition to being unethical, also may have malicious side effects on the computer. Adware is a piece of software or browser cookie that causes unsolicited advertisements to pop-up on a user's computer at various intervals. This can have a significant impact on a computer's performance. These two are grouped together under the term malware.

Malware can cause a laptop to be almost useless if not dealt with. Often it is packaged in seemingly harmless applications or web pages. Through software installation packages or security holes in Internet Explorer, malware makes its way onto a computer without the user even knowing. The most common type of program likely to cause problems are music file sharing software. In addition to clogging up network infrastructures with miscellaneous traffic by setting themselves to run in the background, they often come bundled with a number of malware packages.

Lastly, viruses can make a perfectly solid class setting problematic. Students are not always adept at identifying and removing viruses that infect their computers. Even a student who has virus scanning software which is up to date does not intrinsically understand the impact of a two page list of viruses that F-Prot displays each time the computer boots. Modern viruses compound this problem by self-propagating across a network to exploit vulnerabilities without any user interaction at all. As long as even one user has an infected computer, any unpatched computer on the network is vulnerable.

It is easy to vilify students for their ignorance. In reality, the burden is on those who train and support said students to effectively communicate how to use a computer in a world with all the variables mentioned above. Training programs are constantly being updated to accommodate changing needs and situations. However, it is important to instill in students a sense of responsibility and ownership for their computer. The bottom line is that the computer is a tool and it is issued to students primarily as an academic resource.

5.2 Faculty Development

Drew's excellent faculty continue to make technology in the classroom possible. It is their desire to make good pedagogical uses of technology, guided by Instructional Technology Services. By keeping faculty well trained on the technology and aware of what options are available to them, we enable them to make informed decisions about what role, if any, technology can have in their class.

5.2.1 Faculty

Faculty are a variable in the curricular computing equation only because each one has a different need for technology, and a different view of it. One faculty member, Dr. Kathleen Madden of the Math & Computer Science Department, explains the following, "In math classes, the computer allows students to easily explore complicated functions graphically and it allows them to obtain quick and accurate numerical solutions. Without these abilities, the math curriculum must focus on graphing and solution techniques because in order to explore the applications and properties of a solution, one must be able to generate that solution. With technology we can de-emphasize techniques and focus on what I believe to be the more interesting and inspiring underlying ideas." She is an example of a faculty member who utilizes student laptops in class on a daily basis. However, she points out the obvious problems, "If a class session is designed around some sort computer exploration and computer problems make the exploration impossible, this can be very disruptive. Even minor problems limited to a few students requires that I spend my time helping those students with their computers rather than making my way around the room and discussing course content." She goes on to add, "Another downside is that one has to be careful to design computer experiences that truly complement the course material. The focus should be on the course content and not on the technology." This perfectly exemplifies the need for technology to be transparent and pedagogically appropriate.

Some faculty are willing to require that students arrive for class with functional computers, no questions asked. Others are confounded by what some would think are simplistic glitches. However, from their perspective, they need to teach, not troubleshoot. Some faculty even build time into their curriculum for technological problems. Many are unwilling to accept any glitches whatsoever, based on the amount of content they need to cover in the prescribed time.

Faculty, on a basic level, are human beings with a job to do. That job is central to any academic institution. Beyond training and consultation on the wide variety on technological implementations, a good working relationship with the faculty is a critical component of curricular computing. Developing these relationships on a professional level accommodates understanding, flexibility, proactive assistance, and a general positive experience on all sides.

6. THE SINGLE POINT OF CONTACT

All the preventive measures and proactive steps in the world cannot prevent a problem from occurring in an active classroom. As discussed above, faculty cannot be put in the position of technical problem solvers. Whether the problem is with the instructor's station or student computers, the problems need to be fixed in a no-questions-asked fashion. The best resource to provide for these cases is a single point of contact for all classroom issues. This can be a hotline, a cell phone/duty phone, a team of people, or numerous other things.

6.1 Who You Gonna Call?

This single point of contact (PoC) can coordinate appropriate responses to all incoming calls. In environments where helpdesk support is separated from instructional technology services and media services are housed separately from the faculty development center, it can be highly confusing as to where to turn for help. Not

only does a single PoC remove ambiguity for the users in crisis, it allows technology departments to present a unified front and a professional response to any situation. This person, people, or team is the first to respond to any trouble call from a TEC. They are the ones who must bring all their resources to bear to get the academic programs running again when technology issues arise.

6.2 Plans B Through X

Being aware of what is happening in classes on campus and maintaining positive working relationships enables the PoC to have back-up plans ready to go. If two dozen classrooms all have the exact same desktop in the instructor station with a standard software configuration, one machine can be held in reserve and swapped in anywhere in the event of hardware failure. Not only will having backup plans for most common problems streamline problem responses, it will increase faculty confidence in the service as a whole.

One fallback plan that is often difficult to develop due to monetary constraints is to maintain a pool of laptops available solely to students in a class. These laptops would be for students who do not have time to bring their computer to the helpdesk in the middle of an exam, for example. They would be made available through that PoC. A downside to providing such a contingency is the danger that users will become dependent on it. They can become unwilling to proactively fix their own computers because they know a loaner laptop will be available. However, if limited to emergency situations only, a loaner pool can remain a useful resource. Based on numerous faculty comments, it is safe to say this becomes almost a necessity as the number of classes requiring student laptops increases. We are still figuring out how to deal with this issue.

It is also beneficial to proactively help faculty develop backup plans. If the power goes out, no amount of IT support in the world will help them get the computer running after the battery dies. It is also important for that first responder to honestly and succinctly communicate the scope of any problem that is not readily fixed. With this information, faculty and students can make informed decisions about how the rest of the class will play out instead of waiting for answers.

6.3 Getting it Done

When a class is being disrupted by technological glitches, it rarely matters whose job in the technology organization it is to fix a given issue. The normal lines of support need to be blurred to get problems resolved as quickly as possible. This is where that PoC would go into action.

Picture the classroom shown in Figure 3 filled with fifty students using their laptops on a final exam. Several student computers are not booting and/or connecting to the network. Say there is no classroom hotline, so the person responding is a student technician from the Faculty Development Lab. Have they been trained to handle the situation? Can the faculty rely on them? Those problematic computers should normally be evaluated by the helpdesk, fixed, and returned to the customer as soon as possible. Regardless, it is incumbent on the person responding to do everything in their power to fix those computers, or bring the resources to bear to have the problems resolved. It is irrelevant that this particular person's job is faculty development. If they are responding to a classroom call, they need to be trained and versed in the policies and procedures for answering such important trouble calls.

This is what makes a single point of contact, or TEC coordinator, such a critical role in a modern higher educational technology organization. That person or group can ensure that the best services are provided in a timely manner to get the problem fixed fast.

It is paramount that responders have the support and understanding on all the infrastructure pieces mentioned above. The responder needs to be able to call on anyone in the technology organization to get the answers they need. This requires a two-way trust to be established so that this level of communication will not be abused for minor or easily resolvable situations. All these items pull together in a single cohesive set of services for TECs that, again, provide seamless and transparent support of all available technology.

7. CONCLUSION

It is easy to look at the picture painted here and see a very bleak outlook for curricular computing. On the contrary, having challenges on this level represents an advanced and promising level of technology utilization. The goal is to make actual problems rare through regular maintenance and proactive education while making problem responses swift and effective. By being willing to get dirty on occasion, those who support the technology gain a real understanding of how it is being used in everyday life on campus. Finally, these experiences all come full circle when it comes time to plan new technology enhanced learning spaces. Only by actually working hand in hand with all those who use these classrooms can designers really understand the requirements for a successful technology classroom, in whichever form it may take.

To recap, the five common themes in implementing successful curricular computing are:

- Transparent Technology: The resources provided to both students and faculty must be designed and configured for their academic needs, not for the sake of the technology.
- Student Training: Students must be actively educated before problems arise to understand on a deeper level how their computers work, why things happen the way they do, how technologies interact, and what to do when things go wrong.
- Single Point of Contact: Users in the classroom need one consistent, cohesive set of resources available which will give them the ability to communicate their needs effectively, gain confidence in the tools they use without interrupting the academic process, and receive timely responses to any issues that do arise.
- Integrated Support Structures: The front line of curricular computing is an all-hands-on-deck environment. Technology departments need to work well with themselves and with their customer bases to ensure a productive end result. For example, one way or another, students need to have working laptops in these classes.

- Faculty Development: Faculty members are the beginning of the curricular computing process, and the mechanism for support staff to gain feedback on the effectiveness of the technology resources provided. Engaging faculty in the process at all levels is the best way to build better foundations for any future developments and initiatives.

8. ACKNOWLEDGMENTS

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9. REFERENCES & MORE INFORMATION

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