Wireless Networking
at Drexel University

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EDUCAUSE is a nonprofit association whose mission is to advance higher education by promoting the intelligent use of information technology.

The mission of the EDUCAUSE Center for Applied Research is to foster better decision making by conducting and disseminating research and analysis about the role and implications of information technology in higher education. ECAR will systematically address many of the challenges brought more sharply into focus by information technologies.

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Preface

The EDUCAUSE Center for Applied Research (ECAR) produces research to promote effective decisions regarding the selection, development, deployment, management, socialization, and use of information technology (IT) in higher education. ECAR research includes research bulletins, short summary analyses of key IT issues; research studies, in-depth applied research on complex and consequential technologies and practices; and case studies designed to exemplify important themes, trends, and experiences in the management of IT investments and activities.

ECAR has investigated the state of wireless networking in higher education and has issued “Wireless Networking in Higher Education.” This research was undertaken in three phases:

- an online survey of 391 EDUCAUSE members to establish the state of wireless networking in higher education and to understand its implementation characteristics;
- follow-up, in-depth telephone and on-site interviews, covering 17 selected institutions, with IT personnel and university members who are directly involved with the creation, operation, or use of wireless networks; and
- best practices cases studies with six higher education institutions about their wireless network implementations.

Between March and May 2002, ECAR and IDC began with a list of approximately 150 colleges and universities that had experience implementing wireless networks. From this list, 20 were interviewed extensively by telephone, and six were selected for either on-site visits or extensive telephone follow-up. On-site visits are rigorous and involve nearly two days of interviews and meetings with the widest variety of institutional representatives associated with—or affected by—the technologies or practices being investigated.

This case study was undertaken to draw on the direct experience of others to provide insights into what has—and, as appropriate, what hasn’t—worked in wireless implementations. It is assumed that readers of the case studies will also read the main report, which incorporates the findings of the case studies within the generalized context of the report.

ECAR wishes to thank the leadership of Drexel University for their time, assistance, and diligence in support of this research. We hope readers of this ECAR case study will learn from their experiences.
Introduction

Drexel University's commitment to technology extends back to its origins, when Anthony J. Drexel founded the private institution in 1891 as The Drexel Institute of Art, Science, and Industry, in Philadelphia, Pennsylvania. Today, Drexel's academic programs emphasize both classroom and actual hands-on experience with a technology focus. A Carnegie DR INT institution, Drexel offers 53 majors for its 11,000 undergraduates, and 41 master's and 14 doctoral programs for its 2,500 graduate students. With about 500 full-time faculty, Drexel's class size averages 21 students. In the past year the university has received more than $32 million in research grants and awards.

Drexel's activities extend beyond its own realm. The institution also manages the IT infrastructure and services for Cabrini College and Neumann College and is discussing similar arrangements with other regional institutions. Currently Drexel manages and provides the IT services for MCP Hahnemann University, although the two institutions plan to merge in 2002.

Leading Drexel's wireless initiative is Dr. John Bielec, the vice president of Information Resources and Technology. Ken Blackney, the director of Core Technology Infrastructure, manages the actual design, implementation, and operation of Drexel's wireless networks, while Dr. Janice Biros, associate vice president for Instructional Technology Support, handles end-user support and training requirements.

Other participants in Drexel's wireless strategy include The Computer Advisory Committee, which consists of faculty members recruited to address Drexel's IT policy. Dr. Carol Montgomery, the dean of the library, and Dr. Arnold Smolen, the associate dean of MCP-Hahnemann, are part of the IT management team that meets with Dr. Bielec.

Drivers of Drexel's Wireless Deployment

Drexel's mission focuses on technology leadership. Its goal is “to prepare students for leadership in a complex global society by combining high-quality, technologically enhanced academic programs with innovative research and meaningful real-world learning experiences.” As a result, the university has a commitment to provide current and developing technologies to its community.

Drexel tries to identify the next wave of technology to give its students practical experience early in the technology adoption cycle. For example, Drexel required incoming freshmen to have personal access to a Macintosh computer as early as 1983, expanding to an open platform in 1997.

In the late 1990s Drexel searched for the next new wave of technology. “In 1997, my cabinet of university officers tried to determine what is leading edge,” explained Dr. Constantine Papadakis, the president of Drexel University. “We felt wireless is the number one priority. We want to make a computer an everyday, every hour moment in the learning process.” Wireless enables Drexel to accomplish this vision. Drexel's efforts in wireless networking culminated with total wireless access throughout its campus (indoors and outdoors) in the fall of 2000.

Marketing Drexel's wireless activities has generated considerable print, radio, television, and Web exposure, introducing the university to many potential students. “Wireless is part of a multi-year campaign of technological improvement to build Drexel's reputation as a university,” stated Dr. Papadakis. “IT differentiates Drexel. Wireless is a seen as a way to build on the history of IT success at Drexel.”

Dr. Bielec believes that changing student demographics will force all higher education institutions to rethink how they provide
networking service. “Why wireless?” asked Dr. Bielec. “The 14-year-old today was born in 1988. He has different experiences and expectations. … He considers the computer to be a home appliance, like a toaster. As one publication stated, in many families this child is the TIO—the teen information officer; the person who parents consult with PC problems. Cable/satellite TV, cellular/wireless, instant messaging, e-mail, and chat are expected, taken for granted. And this person will enter college in 2006.” He continued, “This activity is closer than most university administrators realize, many of whom are in their fifties and are out of touch. Nearly 100 percent of college-bound students in high school use the Internet daily. This is the wave of the future.”

Dr. Papadakis also believes that wireless networking potentially decreases PC capital expenditures. “Any classroom is now a computer lab,” he stated. “It provides a lot of flexibility for the faculty. And it eliminates some desktop computer labs. The cost for equipping these labs was a significant capital expenditure.”

**Wireless Deployment Issues**

In 1997, Drexel began its wireless deployment. At the time, choosing a wireless platform was risky because wireless standards were unset. Drexel had to select a vendor platform based on the following criteria:

- **Pick leaders.** “We don’t have the resources to make mistakes over and over again,” pointed out Dr. Bielec. “We look for vendors who have significant market share.” Ken Blackney looks for vendor stability. “I don’t want a vendor that has just a first-generation product; a company that may just disappear. It’s great when a company introduces a neat, new product, but I want to see it work. I like to see the company develop a 2.0 version.”

- **Wait for the breakthrough product cycle.** “We work on Internet time,” explained Blackney. “Things move a lot faster. Wireless is a rapidly evolving technology. Recognize that if all your planning and evaluation of wireless products takes more than six months, you lose a third of the products’ useful life by the time you get rolling on the project. We do our evaluation beforehand, to look for the product’s breakthrough. Then [we] make a full commitment and roll out it rapidly to get the maximum useful life out of the product.”

- **Meet the affordability test.** Before Drexel implemented wireless, it determined whether or not it could afford it. “You can look at cost per outlet in the wall and come to a dollar per unit cost process. If it costs 5 times more to implement wireless, you are not going to install it until it becomes affordable,” said Dr. Bielec. Affordability analysis also extends to the user. “When we first introduced wireless, it was not affordable to the user,” explained Bielec. “The cards cost $375; we subsidized the price down to $300. It was the lowest price we could offer and still pay for the infrastructure.”

- **And the winner is…** Drexel chose Lucent (now the Orinoco line sold by Avaya) as its wireless vendor for several reasons. Lucent was developing its next generation of products, and future products would most likely be standard compliant because Lucent sat on the 802.11 wireless standard committee and co-founded WECA. Its products offer upgrades whole supporting backward compatibility. And as Drexel moved from pilots to full campus implementation, it continued to use Lucent’s products. “Lucent was the first vendor with a 100 megabit uplink,” explains Blackney. “And it also offers power over the
Ethernet, which is a significant cost savings. I was getting estimates of $1,100 per outlet for electricity.” And Lucent enables many different types of antennas to be connected to its APs.

- **Conduct concept testing.** Before Drexel implemented wireless networking campus-wide, it initiated selected pilots. “At the beginning, we really had to literally say to people, look at this technology, look at what you can do now,” explained Blackney. “We did some proof of concepts to show people in a real practical sense how wireless could work. It sold itself.”

So Drexel invented the term *cyberzones*—an area of connectivity without wires. They conducted pilots in high-profile locations, the first of which was the Hagerty Library, Drexel’s main library, in late 1997. The Information Resources and Technology (IRT) department seeded the technology. “We paid for all the infrastructure, we gave the library 10 laptops and cards for students to check out, and then it expanded the number to 30,” said Blackney. “The students borrow the laptops for up to 3 hours for free as long as they don’t leave the building. We aimed for the students, rather than the faculty and staff. In the library, wireless was free and readily available.” Students embraced wireless—the library checked out 3,000 laptop turns per month. Next up was a cybercafe, located in the student center.

In late 1998 and early 1999, academic departments started to recognize wireless’ value. The business school requested wireless access. Again the IRT department paid for the infrastructure out of their budget to promote wireless adoption. Other schools began to request it.

Working with Lucent, Drexel began to plan further wireless expansion. “We originally were going to do about 30 buildings by spring,” stated Blackney, “but at the Spring 2000 commencement, Dr. Papadakis committed to providing full wireless service to the entire Drexel campus by fall 2000. So it was a three-year program from the library to the entire campus.”

### Profile of Drexel’s Wireless Deployment

Drexel’s wireless network uses 36 outside APs and 250 inside APs over its 62-acre campus. At first Drexel transmitted at 2 Mbps, but has upgraded as Lucent upgraded its equipment. Currently, Drexel’s access points have a 100 Mbps Ethernet uplink and 11 Mbps radio transmission. As standards emerged, Drexel has adopted them, most recently incorporating 802.11b technology.

For security, Drexel uses a password secure site to register media access control (MAC) addresses with a RADIUS server. Drexel had planned to use 40-bit wired equivalent privacy (WEP) to support Macintosh users and other early wireless adopters. Eventually Drexel decided to use a virtual private network (VPN) when WEP encryption weaknesses were first reported.

Drexel views wireless as an overlap network providing mobility and convenience, not capacity. (Figure 1 shows wireless coverage on the Drexel campus.) As a result, it implemented its wireless network in two phases. The first phase is coverage area. “Make the wireless signal work everywhere,” Blackney advised. “If it isn’t ubiquitous, the users won’t buy in. In the beginning, there will be few wireless users, so capacity is not incredibly important. The ability to have it work everywhere, however, is critical, so users will think of wireless as a reliable network.” He continued, “Think of cellular service—you get annoyed when there is no signal. A bad signal is better than no signal.” The second phase is capacity, monitoring traffic to add it where needed.
Experience has taught Drexel that real-life conditions frequently limit equipment performance. “The 11 Mbps output is really about 4.5–5 Mbps due to protocols,” advised Blackney. “And while vendors claim a 1,750 foot range; 800 feet is a more reasonable expectation—especially outside. We designed for 400 feet for several reasons,” he explained. “We did not want to get into the 1 Mbps signal range; we want users to be close to an AP, and good outside transmission in the city is hard due to multipath reflection issues. A parked car or a bus driving down the street can impact transmission. Clean, non-reflected radio signals is harder to achieve in the city.” Leaves on trees impact signals, as do building materials. For example, energy-efficient glass blocks signals in addition to heat radiation.
Wireless Usage Patterns

The library first noticed how wireless affected students’ study habits during the initial pilot. Previously, project members worked on different sections separately on their own desktops and pasted the results together later. With wireless, they worked together in a group, with each student using a laptop to complete the assignment. Interestingly, students borrowed notebooks to insert the wireless cards into their own laptops. Now the library loans wireless cards.

Teaching

“Drexel is engaged in providing a huge amount of information online that is accessible wired or wireless. In theory, one could get access to resources without the wireless network, but what wireless contributes is the ubiquitous access,” summarized Dr. Nira Herrmann, professor and department head of the Department of Mathematics and Computer Sciences. “I use wireless for both administrative and teaching purposes. I’m so used to wireless that when it isn’t there, I’ll call up IRT and see if the building is supposed to be offline.”

Dr. Herrmann is the recipient of a Pew Foundation Grant to reengineer a large subscription class, both for maximum use of technology and to improve academic performance. Her project is to reengineer the introduction to computing program courses by using a specially designed lab that is all wireless and facilitates collaboration.

“We designed the room with clusters of computers, all wireless and with a projector,” explained Dr. Herrmann. “Each cluster of students can hook up one of their laptops to a projector, look at the whiteboard, and have a screen projected from their laptop. Students download their assignments, project [them] on a screen, and rotate between the assignment and the solutions. Students check things off and write things next to the screen on the whiteboard. Wireless has really been a very versatile mechanism for changing how we teach the course. It really emphasizes hands-on activities rather than lecturing.”

Faculty also cited its convenience. It is a relatively inexpensive way to guarantee Internet access in every classroom. Professors no longer have to reserve a wired classroom to use online course elements. “I look at it from a matter of access. I will use the computer with my notes on PowerPoint, and the wireless access makes it really, really convenient,” stated Dr. Frank Kelley, a professor at Drexel.

Wireless can distract students, however. “Students might take a quick look at their e-mail and, before you know it, they are totally absorbed,” said Dr. Herrmann. “If you are in a computer room, the abuse is the same, whether it is wired or wireless. I hear the typing and wonder if it is in synch with my talking. Or is it active when I’m quiet?”

Students

Students mirror the faculty’s views, including about wireless’ ubiquitous access. “I have a programming class, and there are not enough computer labs,” explained student Jamie Ly. “So we hold the class in a room without computers. Programming is difficult to do on paper, but with wireless we can access programs through the server.”

Wireless enables students to access material quickly, in or out of class. “With wireless, I can modify my project in class immediately,” continued Ly. “If a professor refers to Point X, I open my files and make the changes right when it [is] still fresh in mind, while the professor is still talking.”

Students, too, are aware of wireless’ potential distractions. “I like to go to a quiet corner and use wireless to access my notes to study without distractions,” said student Mitch Peabody. “Wireless’ flip slide is that it
can be a distraction—especially in class. I’ll access Google.com to search for an unfamiliar term online or if I want a different perspective from the teacher. But, on the other hand, I sometimes find myself doing work from other classes or doing homework for that particular class during lecture. So on occasion I might miss a couple of points. It is more of a self-discipline issue, but it is something to be considered.”

**Gauging the Impact of Wireless**

Dr. Papadakis summed up Drexel’s major wireless’ benefit: “It’s the impact on Drexel’s reputation. Our enrollment has increased far beyond the national trends. We had 13,000 freshman applications this year.” Full-time undergraduate student enrollment increased 46.3 percent from fall 1997 to fall 2001, from 7,000 students to 11,000 students.

Dr. Janice Biros explained Drexel’s philosophy on wireless. “With wireless, we build it, make it available, and let the individual determine its use and initiate his involvement.”

Still, Drexel’s IRT department did seed wireless to foster adoption. “They will come, but we have to make it reasonable price-wise for users to get in. So we subsidized wireless in the beginning by funding the infrastructure and by providing the loaner equipment in the library,” explained Ken Blackney. “Once there are enough student users, it will sell itself. The students tell others; they see their friends using it. The faculty see others using it, and they want it.”

“A good example of this is our equipment upgrade policy,” said Dr. Bielec. “We replace a third of the faculty’s computers every year. Previously, about 80 to 90 percent requested desktops. This year, however, laptops comprised 50 to 60 percent of the upgrades.”

Dr. Biros noticed that more faculty incorporate online course material. “I think the atmosphere at Drexel, perhaps it is not about wireless in and of itself,” explained Dr. Biros. “Rather, access ubiquity [increased] students’ demand for access, and the variety of access has urged and motivated faculty to put more and more things online.”

Drexel standardized on WebCT more than a year ago. According to Dr. Biros, Drexel has more than 200 courses online. “This term we have 90 separate courses taught using WebCT,” she stated. “The 90 courses using WebCT represent 180 different sections, serving 3,000 students. These are hybrid courses involving face-to-face lecturing or face-to-face contact, but with a multitude of materials online. The faculty views this as an opportunity to address student’s different learning styles. Students can learn face-to-face, by listening to online recordings of materials, or by video. And I think the attempt to use WebCT courses makes the best use of the faculty and the best use of the technology. Taking that ubiquity and access to the next level has really motivated faculty to put more and more things online.”

Dr. Hermann concurred. “What wireless really provides is an additional option as to how to present materials. It does not improve the quality of the material to be presented. Wireless is a really good enabler for getting things done online in an accessible manner. I take my laptop to any meeting on campus, and if someone asks about material, it’s right there in my laptop. I have sat across the table and e-mailed someone a file. He opened it, and we talked about it.”

Dr. Kelley urges reluctant faculty members to use online elements—just to keep pace with the students. “Start with raw PowerPoint slides, and then work to integrate other programs,” he advised. “I’ve experienced the students’ progressive utilization of multimedia in my public speaking course. A couple of years ago, one or two
students might use a couple of PowerPoint slides. Now PowerPoint is common, and, in my last course, some students integrated CD-ROMs or video. And this occurred within a term or two. That progression rate is fantastic. I would encourage all faculty to get involved with online elements because it is going to change the way we teach and the way students learn.”

Drexel surveyed its student body about wireless’ impact on their academic experience:
- 45 percent of students rated wireless as very important for academic use; another 33 percent rated it fairly important.
- 78 percent of students using wireless do so in the classroom, 60 percent in the library, 57 percent in the residences, and 54 percent outdoors.

**Spotlight: MCP-Hahnemann Medical University**

In 1986 and 1987, the Medical College of Pennsylvania (MCP) was a small medical school with a hospital in Philadelphia. Eventually it partnered with Allegheny Hospital in Pittsburgh, as the hospital expanded its services throughout Pennsylvania. In 1994, Hahnemann University joined the Allegheny Hospital Network, and the two medical schools merged. Then Allegheny Hospital Network went bankrupt. Tenet Health Care bought Allegheny Hospital Network and looked for a university partner to manage the medical school, with an eye toward a merger. Drexel has managed the university since and plans to merge with MCP-Hahnemann in 2002.

MCP-Hahnemann is the largest private medical school in the country, with 235 medical students admitted each year in the medical school class. It offers two curricular tracks. The traditional curriculum, called Interdisciplinary Foundations of Medicine (IFM), uses lectures and labs. The Program for Integrated Learning (PIL) uses a problem-solving format. Instead of going to large lectures and labs, groups of six or seven students and a faculty member discuss clinical case studies in small conference rooms.

Although not officially merged, Drexel and MCP-Hahnemann operate as one university. Drexel’s IRT group has provided the networking services and IT infrastructure. The MCP-Hahnemann IT department concentrated on developing applications that support the teaching and research programs. A MCP-Hahnemann representative sits on Drexel’s IT management team. So when Drexel decided to offer wireless service throughout its campus, it included MCP-Hahnemann in its plans.

Like Drexel, MCP-Hahnemann is an early adopter of technology. Two years ago, the school required computer ownership of its first-year students to access Internet resources for their curricular support. At the same time, the university added an exit objective for its students: “…the ability to utilize information technology to enhance ongoing learning and professional development, and continuing clinical competence.” For 2002, MCP-Hahnemann pushed the technology requirement further, requiring all entering first-year medical students to have a wireless, laptop computer.

“We struggled whether to have a computer requirement for about 5 or 6 years,” stated Dr. Arnold Smolen, associate dean for MCP-Hahnemann University. “There was disagreement among the faculty. Finally, we just bit the bullet and did it. And at the same time we found a couple of faculty who worked with us to build applications for the students. We started slowly with just a few exemplary applications, and then other faculty saw the power of what could be done with the technology. And little by little, all
of the faculty are coming on board. You just have to start some place, take a little bit of a risk, and ... think creatively.”

Most of the faculty embrace online course elements. MCP-Hahnemann aids those who are not technology wizards. “Some of it is self motivated,” said Dr. Smolen. “But it is also student driven. Students may question faculty if they won’t post grades online, for example.”

The students in the IFM curriculum use wireless to access information resources and to conduct labs on their laptops:

♦ Students use their laptops instead of microscopes to conduct labs. For example, the school loses many slides each year through breakage and old age. It is difficult to replace them. MCP-Hahnemann students now use software to view virtual slides. The software mimics a microscope, allowing the student to zoom and maneuver around the sample.

♦ Courses are taught in modulars—a series of lectures and labs that focus around various symptoms. Faculty post the modular’s resources online, and the students access the material from their laptops.

♦ Students access a central online calendar with class activities posted by day and hour. All entries are hyperlinked to class resources and information for a particular session. Students can import calendar information into the Palm laptops.

♦ For 48 hours after each lecture, students post feedback online, later stored in a database for analysis.

♦ Students communicate on general and course bulletin boards about classes and research.

♦ Streaming instructional videos enable students to see medical procedures before practicing them on humans.

MCP-Hahnemann’s IT team creates these tools with ActiveServe pages on Microsoft Internet Information Servers. The faculty, however, will start to use WebCT next year to maintain their course Web sites.

In the PIL curriculum, students discuss appropriate diagnosis and treatment for a clinical case in a group situation. “And it is in this situation where wireless has made a big impact,” explained Dr. Charles Puglia, a professor at MCP-Hahnemann University. “Students bring laptops into the group to generate concept maps—the rationale for the most likely diagnosis based upon what they have learned. As the cases unravel, students access x-rays, CAT scans, and other relevant materials online with their laptops in the conference room. And they access online resources on the fly—to check quickly the lab value for potassium, for example. The only stipulation is that they cannot bury themselves in the information for more than two, three minutes. They can do a quick search-and-answer on the Web and go on with the class. It has to be a quick, efficient, effective access of information—just like real life.”

“We can see the difference between our first- and second-year students in the PIL program,” Dr. Puglia said. “The second-year students just have to own a computer. They come into the group session happy with the data they researched earlier. Only a few of them use PDAs. The first-year students, who use wireless laptops, are comparing resources, accessing the most recent research articles, and NIH updates right in class. The information they access is amazing, and the level of resolution they bring to a case is tremendous.”

Wireless access will impact MCP-Hahnemann’s third-year students with the introduction of PDAs in clinical training in July 2002. Students will track their patient encounters to share patient histories and physical exams, to log patient visits and their
conditions, and to access medical and drug information online. “Some of the second-year students are a bit anxious about it, to say the least,” stated Dr. Puglia. “Our first-year students, however, are looking forward to it. It is almost a generation change that has occurred between the two classes—one year apart. And it is really the wireless laptops that made that change.”

Dr. Puglia believes infomatics will become a way of life for physicians for several reasons. Doctors will access online information online quickly during a consultation for discussion with patients. Researchers estimate that more than 50 percent of the knowledge that a physician acquires over a lifetime was unknown when the doctor was in medical school. Medical textbooks are often out of date by the time they’re published. “Students must develop the skills to be self-directed, independent learners,” Dr. Puglia concluded.

While MCP-Hahnemann does not publicize its wireless technology use, Dr. Smolen believes “that when prospective students visit us for interviews, they are very impressed that we have wireless. And when the prospects meet with current medical students, they really sell wireless to prospective students. We’ve gotten feedback that it is a major selling point.” An MCP-Hahnemann student agreed. “Using wireless technology is a plus for prospective students. A lot of schools are still old-fashioned. Many new students already have laptops, and all they have to do is buy a wireless card.”

**Lessons Learned**

Drexel community members offer numerous lessons based on their wireless experiences.

### IT Issues

- **Don’t let the fear of making a mistake keep you from making a decision.** “Don’t study wireless too long; just do it,” advised Dr. Papadakis. “And if you make a mistake, you learn from it.” Both Dr. Bielec and Mr. Blackney also emphasized the importance of previous evaluation to make educated equipment and design decisions. Procrastination, however, can significantly curtail the useful life cycle of wireless equipment before the next upgrade.
- **Convenience over capacity is the initial priority.** The actual wireless user population is small initially, but those users will expect comprehensive access, or they will be dissatisfied with their initial wireless experiences.
- **Wireless will not replace the wired network.** Jamie Ly explained, “Don’t ignore the wired network. Not everyone uses wireless, and the wired network is faster. I like having both. I can access the wireless network, but I can also hook up to the wired network pretty much anywhere.” Wireless is not appropriate for large file transfers, backing up files, or transferring online materials because it can impact local performance. Before installing its wireless network, Drexel completed a multimillion-dollar upgrade of its wired infrastructure.
- **Keep in mind the need for power outlets.** “Go wireless for the connection, but don’t forget to power up the classrooms,” advised Dr. Herrmann. “You can’t require students to have laptops [and] not offer any power sources for them. That is the part of wireless that isn’t wireless. Laptop batteries have a finite life. And install lots of plugs to minimize hanging electrical cords. Someone
may trip over your laptop’s cord, and instead of unplugging, the laptop goes flying. We refurbished our auditorium-style classrooms so [that] each seat has a little plug in the arm.”

(include projectors in the plan. Dr. Herrmann continued, “Don’t forget projectors. As it’s easier to post and retrieve materials online, you have to make it easy to display them in the classroom. I would like the same ease in terms of presentation that I have in accessing the Internet. A wireless projector is great. I don’t have to find a plug or make sure that I don’t have two male connections. Every time you turn around, you need a different kind of wire.”

Marketing Wireless

(include the technology to encourage adoption. Drexel’s IRT department’s high-profile pilots introduced the student body to wireless. As acceptance grows among the student body, they drive the rest of the university to adoption. By funding the infrastructure and providing the loaner equipment, Drexel made the community’s initial experimentation with wireless virtually risk free.

(include applications to encourage use. “It would be helpful to have applications online before forcing students to purchase wireless laptops,” stated an MCP-Hahnemann student. “I know a lot of students bought laptops, and then claimed there was nothing to do on them. They, however, tended to be the students that did not want laptops in the first place. It might be better to have applications ready and then force everyone to purchase laptops.”

Include wireless coverage carefully. Where people sit to use computers is different from where they eat and talk to their friends. “Students like to go to a quiet, private place and curl up in a chair to study,” stated Dr. Herrmann. “Installing wireless in libraries and lounges is very important. If you are going wireless and just hook up the classrooms, you are cutting out a major part of usage. More and more, accessing the Web and accessing material online is becoming a major part of all aspects of academic life.”

Classrooms and Pedagogy

Include the student’s potential. “The biggest lesson I’ve learned is not to place unnecessary limitations on people’s abilities to utilize this type of equipment,” stated Dr. Puglia. “The students know more than I do about the hardware, software packages, and online resources that are available. And I am learning from them. Technology is part of the students’ lives, whereas with the older generation it is still a doo-dad.”

Be prepared. “The one downside of technology—whether it is wireless or not—is that when you rely on it, it tends to break,” asserted Dr. Herrmann. “Every instructor who relies on technology in the classroom always has a backup lecture in case everything goes bad, so they are not caught in a class unable to teach. This is not wireless specific, but it is an extra burden of using technology. What do you do when everything fails?”

Technology does not replace sound pedagogy. “Wireless is a good tool for the teacher, but it can’t replace good teaching,” stated Drexel student Mitch Peabody. “It is a snazzy technology, but if teachers are preparing slides on the fly—30 minutes before class—it’s going to come out as a half-baked presentation.”
The Future of Wireless at Drexel

While more members of Drexel Community continue to adopt wireless, the IRT department is confronting other issues.

- **Upgrading the network.** Drexel wants to upgrade its wireless infrastructure to support the faster transmission that 802.11a offers.
- **Costs.** “One fatal flaw of seeding technology is who is going to pay for it,” explained Mr. Blackney. Dr. Bielec wrestles with this concept because he thinks free access and usage encourage wireless adoption. He compares his dilemma with Web sites that offered free information, only to see their hit rates decline when they charged fees.
- **Staying at the forefront.** Finally, Drexel wants to identify the next leading edge technology to adopt and promote. “Wireless was ahead of the wave in 2000; that was the year of wireless,” stated Dr. Bielec. “The next question to answer is, what is leading edge in 2002?”