How Are College Students Using Wireless Internet to Facilitate Learning?

Yong Lu, lu@ohio.edu

Hongyan Ma, ma@ohio.edu

Sandra Turner, turners@ohio.edu

College of Education, Ohio University

Abstract

The purpose of this research was to investigate how college students are using wireless Internet and explore the possibilities of integrating the emerging technology into the curriculum. The research questions are: How are college students using wireless Internet in the classroom and outside the classroom? From the students' viewpoint, what are the benefits and drawbacks of wireless Internet to support student-centered learning? What innovative teaching strategies and practices are instructors developing in wireless environments to support student-centered learning? The study was conducted at a mid-western state university and the participants were college students and instructors. Student-centered learning theory was used as a theoretical framework. Web survey and semi-structured interviewing were employed. The research found that wireless Internet can promote student-centered learning by providing a choice of location, better learning environment, flexibility of time, easy involvement in group projects, and improved communication with instructors and other learners. New teaching strategies and models need to be developed to take full advantage of wireless technology.

Keywords: wireless Internet, student-centered learning, college students, teaching strategies, higher education

Introduction

A recent survey (Wireless Networking in Higher Education, 2002) of 392 EDUCAUSE member institutions found that wireless Internet in higher education in the U.S. and Canada "has moved from an interesting curiosity to an appealing technology alternative for potential users" (p. 1). In the Campus Computing Survey Project (Green, 2002), more than 630 chief information or chief technology officers at two-year and four-year public and private colleges and universities participated. The survey data revealed that wireless networks were an increasingly important issue across all sectors of higher education. About two-thirds (67.9 %) of the institutions participating in the 2002 survey reported that they had functioning wireless LANs, compared to half (50.6 %) in 2001, and 29.6 % in 2000.

Wireless technology is quickly gaining a foothold on many campuses as a means to achieve mobility and "anywhere, anytime" access. Boerner (2002) listed some characteristics of wireless networking on campus: mobility, installation speed and simplicity, installation flexibility, reduced cost of ownership, and scalability. Wireless Internet is affecting not just the classroom environment and technology access, but also the actual activities of learning and teaching. According to the EDUCAUSE study, wireless Internet "represents a user-centered shift, providing students and faculty with greater access than ever before" (Wireless Networking in Higher Education, 2002, p. 4).

Other campus administrators, however, say that although students love wireless Internet, the teaching has not changed. Not all instructors value the student-centered approach to learning. Bhave (2002), for example, predicted that wireless Internet would be a challenge for teachers' authority and raise issues of control. He said that when wireless technologies permeate classrooms in schools and colleges:

> *They will raise issues of stewardship and control for the teacher. How can a teacher assert the necessary and traditional control over classroom proceedings to remain effective? How can a teacher retain focus and discipline in the classroom when students multitask with ease? (p. 17)*

Although wireless access to the campus network is becoming commonplace, institutions are still at the beginning stage of adoption in education. "There is plenty of potential in this technology for teaching and administration–everything from classroom management to providing network service for temporary locations" (Grush, 2002). The potential impact of this new technology on learning and teaching is significant enough to gain our attention as researchers.

Theoretical Framework: Student-Centered Learning

The purpose of our study is to investigate how students are using wireless Internet to enhance student-centered learning. Student-centered learning environments are designed to provide students with opportunities to take a more active role in their learning by shifting the responsibilities of organizing, analyzing, and synthesizing content from the

teacher to the learner (Means, 1994). These environments allow students to examine complex problems using a wide variety of resources, develop their own strategies for addressing these problems, and present and negotiate solutions to these problems in a collaborative manner (Hannafin, Hill, & Land, 1997).

Student-centered learning is contrasted with instructor-centered learning. Traditionally, learning is controlled by the instructor to meet certain goals set up by an institution or an instructor. Student-centered learning can empower students to meet their own goals. Oblinger and Maruyama (1996) contrasted the two learning models. The authors described instructor-centered learning as a learning model that puts an organization or a function at the center, where students "must move from place to place or person to person" (p. 6). A student-centered learning model, on the other hand, is a model where students can have "more flexible access to people and information" (Oblinger & Maruyama, p. 6). Two diagrams were used to illustrate the different models (Figures 1 and 2).

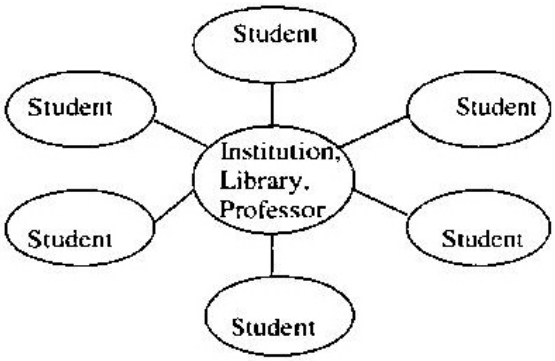

Figure 1. Instructor-centered learning (or organization, function-centered learning)

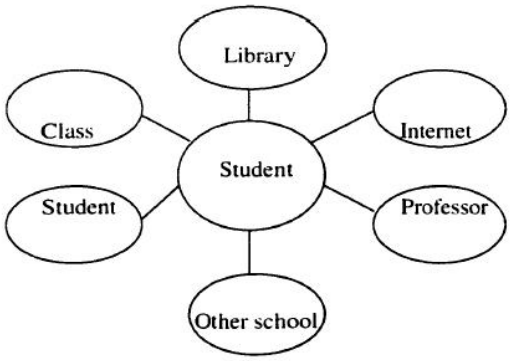

Figure 2. Student-centered learning

Source: Oblinger & Maruyama, 1996, p. 6.

The following factors will change in a student-centered learning environment: the role of instructor and learner, and concepts of place and time (Oblinger & Maruyama, 1996). The instructor becomes a facilitator of the learning environment instead of "a sage on the stage". The learners become active "doers" instead of passive receivers. The learners are actively engaged in learning activities through presenting, analyzing, solving, constructing, collaborating and self-evaluating. Place is not restricted to the classroom; it may be extended to a "virtual environment" in which learning takes place. Time also becomes a variable; rather than a fifty-minute lecture, the length of the learning activity can expand to fit the learner's schedule and educational goals. In addition, technology will have different features in a student-centered learning environment. Technology will have the features to support two-way, many-to-many communication instead of one-to-one communication between learner and instructor (Burge, 1998). It is worthwhile, then, to examine the connection between wireless Internet and student-centered learning.

Method

Research Setting

The setting for this study was at Ohio University (OU), a state university in rural southeastern Ohio. Ohio University has one main campus and five regional campuses. Enrollment at the main campus totals 19,920 students: 16,712 undergraduate, 2,792 graduate, and 412 medical students. Enrollment for the five regional campuses totals 7,192. Ohio University is committed to providing the technology students need to succeed in today's educational environment. As evidence of that commitment, a computer with printer and Internet access is provided in every student's room in the residence halls.

In January 2002, Communication Network Services (CNS) of Ohio University started a wireless networking project (called "First Wave"), and free wireless Internet access currently is available in many buildings and outdoor locations on the main campus. The free wireless Internet is also available in some buildings at the regional campuses, such as libraries, academic buildings. CNS is expanding wireless Internet coverage. In winter quarter, 2003, CNS hosted three demonstrations about wireless Internet in Alden Library to help students and faculty install wireless cards and troubleshoot problems. It is timely to conduct a study on how wireless Internet is affecting student-centered learning under this particular condition.

From CNS Wireless Progress Report (2004), the number of unique wireless Internet users on track surpassed 2,000 in the month of February 2004 (Figure 3). The data also show the wireless use clearly linked to students: the reason for the big dip in December 2003 is that students were on winter break.

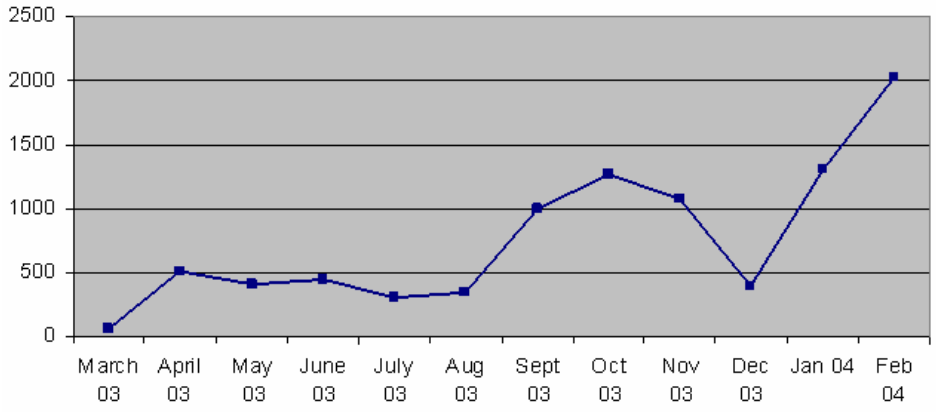

Figure 3. Number of unique wireless users (Wireless Progress Report, 2004)

Research Instruments

The research combined both qualitative and quantitative methods of design, data collection and analysis, but it was primarily a qualitative inquiry. Data were collected from wireless-using college students through interviews and a web survey. The purpose of the survey was to get a general picture about how students are using wireless Internet and to identify potential interviewees. The interviews provided in-depth, rich details about how students are using wireless Internet for learning. Interview questions focused on how the technology facilitates students' learning, such as, "Describe the activities you use the wireless Internet for? How do you use the technology for study?" "Describe how you use the technology to locate, evaluate, and collect information from different sources?" "Does the technology help your study, for example, enhance learning, increase productivity, and promote creativity? And how?"

Although other researchers have conducted surveys about college students' use of wireless Internet, they focused primarily on characteristics of users and technology issues. There are few surveys about the role of wireless Internet in college students' learning.

Therefore, we developed our own questionnaire for this project. The questionnaire took about 15 minutes to answer and included demographic information and a Likert-type summated scale with four components: wireless Internet and student-centered learning, use of wireless Internet in class, benefits and barriers of wireless Internet, and technology issues related to wireless Internet. The questionnaire was piloted with four college students and revised based on feedback from the respondents. Our questionnaire link on the Web is: http://oak.cats.ohiou.edu/~yl291400/wireless/survey.html.

Subjects/Participants

College students who are using wireless Internet were the major participants of the study. College instructors who have experience using wireless Internet in their classrooms are also being interviewed to provide the instructors' perspectives on how students are using wireless Internet for their learning and to triangulate the findings from students.

While surveying the students, the questionnaire asked the respondents who were willing to be interviewed to provide their contact information. From the list, the researchers identified the interview participants. Other participants were reached through snowballing. That is, the interviewees provided their friends' or instructors' names or information that attracted the researchers' attention to interview people they talked about during the interviews.

Data Collection

The major methods of data collection were survey and interview. With the help of CNS, we sent out an email message with a link to the web survey to all OU students

(24000+ email addresses) through a university mailing list during the fourth week (Oct 3, 2003) of the fall quarter, 2003. We received 189 responses by the end of fall quarter (Nov 26, 2003), among which 186 were valid. Many students not only finished the Likert scale and demographic information questions, but also left comments and contact information for an interview.

After the survey, we contacted students and instructors for further interviews. Semi-structured interviews were employed to elicit in-depth responses. All the interviews were conducted face-to-face and tape-recorded for transcription. Each interview was based on self-report and lasted about 30 minutes. We interviewed 11 students (9 male and 2 female) and 2 instructors so far (one male and one female).

Results and Interpretation

Data collected through the survey were entered into SPSS for descriptive analysis to see patterns of students' use of wireless Internet. The variables of interest included gender, student status, and student-centered learning activities. There were more male respondents (62.3%) than female respondents (37.7%). Most of them have their own laptops (80.7%), and most of them purchased a wireless network card (79.8%). Nearly half of the respondents (47.2%) used wireless Internet everyday, 25% used it several times a week, 15.3% used it several times a month, and 12.5% used it less than once a month.

For the questions related to wireless Internet and student-centered learning, the students showed consistently positive attitudes that the wireless Internet can help their study and learning (Figure 4). The majority of students strongly agreed or agreed that

wireless Internet helped them to collaborate more with others in doing their homework, while only 16% disagreed or strongly disagreed. Two-thirds agreed or strongly agreed that wireless Internet helped them to study and improved their communication with classmates and teachers. A similar number reported that they preferred to use wireless Internet to do research—that it helped them to locate information from a variety of sources and was adaptable to their personal learning style. However, only one-third of the students strongly agreed or agreed with the statement that there is not much difference between wireless Internet and wired Internet for study.

Question	SA	A	N	D	SD
1. Wireless Internet helps me to collaborate more with others in my homework.	28.5%	24.2%	31.2%	10.2%	5.9%
2. I prefer to use wireless Internet to do research.	37.3%	27.6%	24.9%	4.9%	5.4%
3. There is not much difference between wireless Internet and wired Internet for my study.	9.7%	23.8%	21.2%	28.6%	16.8%
4. Wireless Internet helps me to locate and collect information from a variety of sources.	33.1%	32.6%	26.4%	3.4%	4.5%
5. Wireless Internet can adapt to my personal learning style.	37.2%	30.6%	25.7%	2.2%	4.4%
6. I enjoy getting information from books and the wireless Internet equally.	15.1%	29.6%	21.0%	22.0%	12.4%
7. Wireless Internet helps my study a lot.	30.5%	35.6%	23.7%	5.6%	4.5%
8. Wireless Internet improves my communication with my classmates and teachers.	33.9%	34.4%	20.8%	6.0%	4.9%

Figure 4: Wireless Internet and student-centered learning

The interview transcripts and the answers to open-ended questions of the survey were coded and analyzed based on the themes that emerged in the interviews. Patterns were identified among the themes to see how students are using the wireless Internet for their learning and what major benefits and barriers they have encountered. Students

appreciated wireless Internet for its flexibility, mobility, versatility and new possibilities. The data provided evidence that wireless Internet can promote student-centered learning in five major aspects: mobility, learning environment, flexibility, collaboration, and communication.

Mobility

First and foremost, students in the survey and interviews showed their enthusiasm for the mobility of the wireless technology. They felt that being able to study at any location helped them learn better. One student told the researcher, "Wireless Internet is ready to use when I'm ready to use it. When I want to study, I don't have to be restricted to a desk to do it." Another student said, "It doesn't tie you down. I could be anywhere…almost, and still be able to look things up." One student commented about the ease of doing research, "I use the wireless Internet to do research because I am free to move from place to place without the use of any messy cords. If someone is being loud in my room, I can easily move down to the study."

Learning Environment

The second aspect of wireless Internet is that it allows students to choose a conducive learning environment. Students reported that they can study under better conditions such as a well-lit desk, a less noisy room, a less crowded area, a comfortable and pleasant place. One student liked to sit outdoors to do research, "It is very stress-relieving to be able to sit in the College Green while doing research." Another student said, "(I) can sit in a nice park and listen to soothing bird song." According to these students, a better

environment can make learning more effective because their mind works best in a pleasant and comfortable place.

Flexibility

The third theme emerging from the interviews is the flexibility of time for studying. Students of all different backgrounds mentioned that with wireless Internet, learning can take place at any time and therefore they can make more efficient use of their time. One student said, "I can use the time in between classes as well as during general studying times to my fullest advantage." One art student talked enthusiastically about the immediateness of wireless Internet, "I can get critiques in real time about my photograph, from people in class and people on the online community." Another student said, "I often study and work on projects while doing other things; for example, I sometimes bring my laptop into the kitchen to work while cooking dinner." A female student described her experience,

> *I am a part-time student busy taking care of a toddler. Therefore I prefer to study later at night when my kid is asleep. By using the wireless Internet to do research for my studies is the most convenient way for me. …In order to save time, I prefer to check into the libraries of different sources to get the electronic journals instead of physically travel to each library to get the hard copies.*

Collaboration

The fourth aspect is collaboration with classmates in group projects. Students reported that wireless Internet can make collaborative learning more likely to happen. One student said, "I can study with a group of friends, and do research and talk to other

students with my wireless computer." Students mentioned that they could work with others on the same project while they are physically in many different places. A student concluded that, "(You) can be anywhere and still have a large group you working with."

Communication

The fifth aspect is improved communication. Students said that wireless Internet made it easier for them to communicate with other students, their professors, their family and friends. Another student said, "I am able to check my email much more, so I keep in contact with my instructors and classmates." Another student pointed out the educational value of improved communication, "We can send information back and forth over wireless Internet. This would boost communication, which in turn would boost learning. The best way to learn is to clearly communicate information from one person to another."

Wireless Internet in the Classroom

Although most students did not use the wireless Internet in class, they expressed hope for using it in the classroom. While asked about whether they wanted to use wireless Internet in a classroom and why, the majority of the survey respondents and interviewees said yes and they provided different reasons. One student said that she learns better through seeing than listening and would tend to remember more using wireless Internet in class to view information on her laptop." Another student said, "Information is much easier to obtain and share, therefore I am more effective in collaboration." Another student commented that groups for class discussions could be more flexible, "We can have a group discussion without the limit of special group. People interested in the same

topic can talk no matter where they sit." From these interviews, it is evident that students can see the potential benefits of learning in wireless classrooms.

As to the benefits for teaching, one instructor who teaches languages said that with wireless Internet, instructors in his department just moved a cart around to different classrooms. Students in the classroom used laptops to access the Internet and they did not have to go to a lab to wait for a computer. The instructor used wireless Internet for all classes he taught: writing, listening, speaking, grammar, and reading.

The instructor also described one innovative teaching strategy that he used in his classes. Using the software, "Network Administrator" on Mac, he said he can easily manage wireless Internet activity in class: lock or unlock wireless Internet, copy files, and observe how much time students spend online and what links they access.

In the interviews, one instructor reported a viewpoint that differed from the literature. One study in the literature reported that wireless Internet access in classrooms may distract the students from the learning process because students may access non-pertinent content during class/lecture time (Boggs, 2002). In our study, an instructor described the teaching by saying that students can be more involved in interactive learning activities while using wireless Internet. When they finished research on the Internet, they could easily close up their laptops and engage in discussion or listen to the instructor. In contrast, desktops in a lab may obstruct students' view of other people in the classroom and discourage classroom interaction. It will be interesting to hear what other instructors and students say regarding this issue as we do further study on this topic.

Discussion

From the survey and interviews, many students expressed the expectation to have more wireless coverage across campus. The students said that they did not use the wireless Internet in class because many classrooms were not equipped with wireless access. Some students mentioned that they set up their own wireless access points at their dorms, apartments, or houses. Several students can share one wireless network, which makes access to the Internet more cost-effective. CNS also recognizes the need for wider coverage and is expanding the wireless project. More and more buildings and classrooms are being equipped with wireless connectivity.

Institutions are in the beginning stage of implementing wireless Internet in education and only a handful of instructors are using it in classrooms. As is shown in our study, students are ready to learn in a wireless classroom, and they are enthusiastic about the potential of wireless Internet because it allows them to be active learners where they can choose the location, time, and mode of communication for their learning. However, there are very few instructors using this technology in their classrooms. Some do not even know about it. As the wireless project is expanded, we believe that more instructors will implement the wireless technology for teaching, research, and management.

Interviews with two instructors showed that new strategies and learning models need to be developed for the instructors if the institution wants more instructors to integrate wireless Internet into classrooms. The institution has to make a long-term sustainable plan to develop wireless curricula, instructional strategies, and professional training models. Examples of lesson plans need to be provided for instructors interested in

wireless Internet use. Good learning models and practices serve as motivation for the instructors to adopt the new technology, too. The researchers feel that it is necessary to interview more instructors who are actually using the wireless Internet in classrooms so as to provide more high quality wireless curricula and lesson plans in different content areas.

References

Bhave, M. P. (2002). Classrooms with Wi-Fi: A challenge for teacher control and a revolution in learning. *T.H.E. Journal, 30*(4), 17-23.

Boerner, G. (2002). The brave new world of wireless technologies: A primer for educators. *Syllabus, 16*(3), 19-30.

Boggs, R. (2002). *ECAR study: Trends in wireless communications in higher education*. Retrieved January 29, 2003, from the World Wide Web: http://www.educause.edu/ir/library/pdf/EDU0218.pdf.

Burge, E. (1998). Gender in distance education. In C.C Gibson (Ed.), *Distance Learners in higher education* (pp. 25-45). Madison, WI: Atwood publishing.

Green, K. C. (2002). Campus computing looks ahead: Tracking the digital puck. *Syllabus, 16*(5), 22-25.

Grush, M. (2002). Editor's note. *Syllabus, 16*(3), 4.

Hammond, K., & Salpeter, J. (n.d.). *Cutting the cord: Wireless computing comes of age*.

The Consortium for School Networking. Retrieved January 20, 2003, from the World Wide Web: http://www.cosn.org/initiatives/compendium/3.pdf.

Hannafin, M., Hill, J., & Land, S. (1997). Student-centered learning and interactive multimedia: Status, issues, and implication. *Contemporary Education,* 68(2), 94-99.

Means, B. (1994). Introduction: Using technology to advance educational goals. In B. Means (Ed.), *Technology and education reform: The reality behind the promise*.

San Francisco: Jossey-Bass.

Oblinger, D. G., & Maruyama M. K. (1996). Distributed learning. Boulder, CO: Cause Professional Paper Series, # 14.

Wireless networking in higher education in the U.S. and Canada. (2002). Retrieved January 19, 2003, from the World Wide Web: http://www.educause.edu/ir/library/pdf/ecar_so/ers/ers0202/EKF0202.pdf**.**

Wireless Progress Report. (2004). Retrieved April 4, 2004, from the World Wide Web: http://www.cns.ohiou.edu/hot_topics/wirelessprogress/frame.