Abstract - The paper describes the usage of mobile laptop computers in closed labs for the Computer Science majors. The Computer Science Department at Salem State College, Salem, MA modified the Computer Science major curriculum in 2001 to add closed labs to all appropriate Computer Science major and minor courses (more than sixty percent of the total number of courses taught). One of the consequences of this decision was the need to conduct several simultaneous closed and open labs in parallel. The existing laboratory infrastructure was insufficient to support this additional load and we decided to introduce a laptop based mobile lab to satisfy the increased computer hardware and lab space requirements. We describe the steps taken to implement the lab and present the analysis of the results and the problems encountered during the two-year usage of this new teaching environment.

Index Terms - Closed computer labs for Computer Science majors, mobile computer lab, wireless laptops in the classroom.

1. INTRODUCTION

The concept of using mobile computer devices in teaching is getting a lot of attention in recent years. Several colleges and universities cite significant convenience and cost savings [1] as the major reason for using wireless network access. In certain situations, students are required to lease a laptop and wireless network adapter [2], which, among other benefits, results in cheaper Internet access in the dorms.

The University of Akron [3] analysis showed that they could free seven computer labs that occupy "prime real estate" on the campus by turning part of the library into a wireless computer lab. This will free up the old computer lab rooms for classes.

On the other hand, the concept of closed labs is becoming popular in teaching different level computer science courses. The Computer Science Department at the Randolph-Macon College in Ashland, Virginia uses closed labs to teach the development of Java GUIs [4].

The concept of studio teaching [5] is the cornerstone of the Java teaching approach by the Department of Information Science at the Donaghey College of Information Science and Systems Engineering, University of Arkansas at Little Rock. They developed a hands-on computer science-teaching curriculum that includes studio teaching based on the usage of verbal, visual, and kinetic methods.

Colleges and universities often have difficulties in providing sufficient space for classrooms, faculty offices and labs. The ever-increasing need to educate people in the general and discipline specific uses of computers leaves Computer Science educators with a severe lack of locations (labs) in which to conduct that education. We can convert classrooms to labs, but we may not have enough classrooms either.

This paper presents one of the viable approaches for solving the space problem - the usage of a mobile laptop computer environment specifically in conducting mobile laptop based closed labs for undergraduate students majoring in computer science.

2. BACKGROUND

There are a large number of conventional courses in which computers in the classroom may assist instructors in teaching as well as allow the immediate use of some of the significant tools that can be applied in these courses.

A different approach is to bring the computer lab to the students. If a class needs hands-on instruction for all or part of a lecture, a cart of laptops may be brought to the classroom, and the laptops distributed to the students.

Wireless laptops equipped with wireless access points allow a group of laptops to form a virtual computer lab and provide a short term or possibly even a long term solution to the problem of teaching the infrequent (yet necessary) computer oriented lectures in non-computer courses.

Finally, another important advantage of using mobile computer equipment is in providing flexible lab space for a large number of closed labs required by the Computer Science Curriculum.

3. EXPERIENCE TO DATE

The Computer Science Department at Salem State College has long relied on the use of only "open" laboratories for our programming courses.

While this kind of lab has been the method of choice for many years, and the one experienced by most of our faculty, closed labs are becoming the norm on many campuses.

Closed labs have become more important as the percentage of the population studying computer science and related disciplines has grown. We can no longer rely on a students’ ability to struggle with the computer on their own, especially since some of the tools and environments used in Computer Science are becoming increasingly more complex.
Starting with the 2002/2003 academic year, the Computer Science Department at Salem State College required all Computer Science majors and minors to attend the closed labs as a mandatory component for the majority of our courses.

Our analysis at that time showed that closed labs would consume nine of the twelve possible class periods available in our departmental computer lab.

After the approval of closed labs by the college governance, we selected a mobile wireless computer lab as a potential solution to the problem of the department computer lab overloading. We also acquired an overhead projector that can be connected to one of the laptops for use by the instructor.

The mobile laptops have been in use starting with the Spring 2003 Semester. The computer science department now has a mobile lab with eighteen wireless laptops that:

- have wireless access to the Computer Science network servers, the college LAN and the Internet;
- allow regular classrooms to be used as mobile computer labs;
- are housed in a single computer cart that provides power cords and outlets for recharging the laptops;
- and, most importantly, can be rolled into any Computer Science classroom.

4. ANALYSIS

Starting with the Spring 2003 semester we have used the mobile closed computer labs in fourteen Computer Science courses over three semesters. Approximately 200 Computer Science majors and minors took these courses. The analysis of the resulting student grades shows that there has been a large reduction in the number of students receiving incomplete grades as a result of not completing programs while achieving passing grades on exams. One course which had been presented using Java without a closed lab had a rate of incomplete grades over 50%. The next two times it was presented it used Java and a closed lab, one a fixed lab and the other mobile. These classes had two and one incomplete grades respectively.

The scheduling of the mobile labs has in most cases been a pair of 75-minute sections, one for lecture, the other for lab on each of two days, either Tuesday and Thursday or Wednesday and Friday. When possible, the first class of the pair was the lecture. However, in order to allow an intervening recharge period, sometimes the lab was scheduled before the lecture. Over the last three semesters, mobile lab classroom schedules were developed to allow for at least two or three courses in a single day.

We have also tried a single three hour mobile lab one day a week. The instructors’ opinion was that this represented the best usage of lab time, but it proved unpopular with students, because the lab time was separate from the 75 minute lectures and scheduled in an unrelated timeslot.

Most importantly, the student opinion regarding the usefulness of the closed labs in general and the mobile computer laboratory in particular is generally extremely positive. Most of the students comment that the ability to get qualified help from an instructor in real-time makes a difference in their comprehension even for the most advanced Computer Science courses.

During the last semester we have initiated Student Questionnaires, aimed primarily at the analysis of course definitions and syllabi as part of our Assessment Procedures. Three of the questions asked relate to the closed labs. They are:

- Effectiveness of closed lab exercises in understanding important course concepts;
- Effectiveness of closed lab exercises in learning important technical details;
- Effectiveness of instructor availability and support in closed lab.

Students’ answers to these questions averaged between very effective and effective in all end of term Questionnaires.

5. CONCLUSION

Wireless laptops have provided us with a viable solution to our need for more closed lab space.

Housekeeping issues have been non-trivial, but are well within reason. The benefits of computer usage in a conventional classroom make the wireless laptop a worthwhile investment for the College, provided that class and lab scheduling is handled properly and staff is available to allow for the necessary housekeeping.

The obvious success of our initiative implies the potential for the creation of relatively low cost alternatives to standard desktop based computing labs for Computer Science majors and non-majors as well as the expansion into mobile handheld computer labs.

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REFERENCES


