Mobile, Agile, Versatile: The Use of Tablet PCs and Wireless Technology in Introductory Programming

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Abstract

This paper focuses on the use of wireless and mobile technology and the latest teaching and collaboration software in an introductory Visual Basic Programming course. This course is a general education course and presents unique educational challenges and opportunities.

Keywords: Pen-based computing, Tablet PCs, wireless computing, programming, active learning

1. Background

Technology integration is an important part of many educational programs. The field is constantly evolving as new technologies evolve. Hand-in-hand with new technology is the use of instructional methods that encourage student participation in the classroom. This is often referred to as "engagement." The National Research Council encourages the use of "active learning environments for all students." (National Research Council, 1999) The latest technologies are more interactive and more pervasive. These include the latest pen-based devices (Fitzgerald, 2004). The use of pen-based technologies are well-suited for such use and that their use in computer science classes is especially useful (Berque, 2004). Their implementation in a wireless environment adds additional utility. However, there are limitations and problems with the devices as students are easily distracted (Campbell & Pargas, 2003).

Dakota State University is a small, midwestern university with a long history of liberal arts education. In 1984, the South Dakota Legislature changed the mission of Dakota State to focus on information technology. Since then, there have been significant changes in the curriculum, the addition of several Masters programs, the opening of a satellite campus, the instigation of distance programs and a doubling of enrollment.

General education at DSU includes two computer classes, CSC 105: Introduction to Computers where students learn computer concepts and fundamental applications. The other course is a programming course, either CSC 150: Principles of Programming or CIS 130: Visual Basic Programming. The two general education courses provide a background for information technology integration throughout the curriculum.

Dakota State University offers three Visual Basic programming classes. CIS 130: Visual Basic Programming is a general education course and is taught to nearly 90% of the students. CIS 130 (VB) has five to seven classrooms sections each semester and has been offered via the Internet for eight years. The course was traditionally taught in the classroom until a gradual shift to the lab a couple years ago. CIS 151: Business Applications Programming is required for Information Systems majors, all Business majors, Computer Education majors, and various other majors and minors. CIS 361: Advanced Programming for Business Applications is offered as an elective. The

focus of this paper is on the integration of the latest technology into the Visual Basic classes, mainly the general education course, Visual Basic Programming.

The campus has numerous labs to accommodate classroom teaching and student work. In 2002, the campus began a move to accommodate wireless technology on campus. With minimal funds, wireless hubs and servers were added to the network in select, high-traffic locations. In 2003, several wireless projectors were added. In addition, faculty development funds were used to purchase Gateway Tablet PCs and docking stations. The faculty was then expected to learn how to use the tablets and wireless technology and begin integrating them into their classrooms and routines. By the end of the year, several were confident enough in the systems that they gave up their desktop systems. Other funds were used to install tablet labs with the same Gateway tablets and docking stations. The Introduction to Computers course was taught in this lab.

2. Shift to a Wireless, Tablet Environment

With these successes in 2004, the decision was made to incorporate wireless technology throughout the campus. All freshman and sophomore students were required to purchase or lease a Gateway M-275 PC or an equivalent. Over 800 systems were initially purchased student and faculty use. The students can lease the tablets for $275 per semester. Upperclassmen were not required to have a tablet, but they were extended the same purchase and lease options. Classrooms and faculty offices were furnished with docking stations. Again, faculty development monies were used to purchase tablets for the faculty. Approximately $140,000 from a special grant from the governor went into faculty training and development. The purpose of this was to incorporate technology into the curriculum. In part, this was seen as a way to stay in the forefront of technology education and to serve as a model for cost-saving initiatives.

In 2004, faculty were awarded "Faculty Development" grants attended training on the new computers, WebCT, wireless technology and educational goals and student learning outcomes. The expectation was that they would redesign their courses to include wireless capabilities, use of the tablet computers in their classes, introduce new teaching methods that incorporated the technology advances and develop student learning outcomes that matched the new pedagogy. Approximately 40 faculty members, most of them teaching one or more sections of a general education course, took part.

The campus-wide wireless network has access points throughout the campus allowing access at up to 11 megabits per second. Computer labs and most classrooms have a mounted projection systems. Faculty has control of these systems through AirProjector software. With this they can project their screen or accept input from any student and project it on the screen. For testing, software called SynchronEyes from MicroAge (www.smarttech.com/products/synchroneyes/index.asp) is used to monitor student computer use.

Students in the VB classes make use of Visual Studio .NET 2003 edition. The software is installed on their tablets before the students get them. The campus has an agreement with Microsoft for the installation and use of Visual Studio and a large number of other applications. This license costs $800 and allows students and faculty to install many Microsoft applications on their machines, on lab machines and at home. In addition, the texts used in the courses come with a student version of the software that the students can use while enrolled in the course.

Each tablet comes with Microsoft Journal. This software takes almost any document or screen and turns it into a note-taking document. Faculty can use this to take a student assignment, a writing document or a program for example, and write notes on it. Another innovative tool is Microsoft OneNote. With it, users have a notepad that can be used to paste text and graphics as well as write or type notes. PowerPoint, of course, comes standard and students and faculty can use it for displaying the standard presentations that come with most texts.

For teaching, the courses make use of WebCT. Course information is posted along with course materials. Students login to WebCT to find course information and materials for all of their courses. Quizzes, testing and student surveys are posted to the site. Students are encouraged to buy the ebook version of the text. The materials come in a format that can be read by Adobe Acrobat Reader (www.adobe.com). There are many online features available with an ebook that are not available with a traditional text. Students are expected to make good use of email and to submit their assignments electronically. Sample programs are available on the WebCT sites as are student assessment quizzes. The students can take these as practice for tests. The publisher's website has practice and review materials as well.

3. Instructional Units

A typical unit of instruction can follow this general pattern:

Prior to classes, students are expected to use WebCT to download the needed class materials. This could include the PowerPoint materials, sample programs, Notes, outlines and other materials as posted by the instructor. They are expected to read the appropriate materials from the text, either the traditional softcover text or the ebook version. Students should also check the publisher's site for materials and updates.

In class, the instructor uses PowerPoint slides, examples and discussion to cover the materials. The instructor and students use tablet PCs in class. An air projector is used by the instructor to display materials for the lecture/demonstration and they can readily switch to the tablet PC of any student. With this they can display the student's problem or solution to the entire class. For example, if a student had modified a sample loop program to create an infinite loop, the instructor could display this program to the entire class. From there, the instructor could show how to break the program to get out of the loop and how to correct the error in the code.

The publisher's web site has practice quizzes the students can take at any time. There are other materials they can download and use a well. Students can download sample programs from the instructor's WebCT site. These are zipped archives that the students can unzipped, open and run. These are used as samples or practice. The instructor can post practice quizzes for the students as well. These questions can be tailored to the instructor's points of emphasis. The instructor posts assignments and materials to WebCT. Students complete programming assignments, zip them, and upload to WebCT for grading. The instructor or work study students then download the programs to a student directory and unzip the archive. The program is opened, tested and then graded. The code is printed to a Windows Journal file where comments are written in a comment box or with ink. This file is then uploaded to WebCT where the student can view the comments. The turnaround on assignments can be much faster. As assignments are graded, the results can be posted and the student comments returned. An instructor wouldn't have to wait for the next class.

There is also a place in WebCT to write comments on assignments. The graders post student scores in WebCT. WebCT has numerous grading features. Student scores can be viewed and some statistical analysis can be done on them. While cumbersome, it can calculate and display student course grades.

Testing can be done through WebCT. It handles mostly objective questions and there are numerous security controls in place. Further security is provided by SynchronEyes. It keeps students from switching applications during testing. Student cannot open new windows, copy and paste, print, switch screens, take screenshots, or access files during testing. They are limited to the window provided for testing. While it's limited to objective-type questions and short answers, it does provide most of the controls that a standard paper-and-pencil test provides. What WebCT and SynchronEyes do not provide is the ability to do practical testing where students would write a program or snippets of code. WebCT testing will automatically grade and post scores for a test.

Online calendar features allow students to check faculty schedules and even schedule

an appointment online. This feature appears to be a mindset issue for students. It is often easier to just show up at a faculty member's door. Some might even call first, especially if a walk or stairs are involved. However, checking the schedule and then reserving some time makes it easier for everyone involved. There is a discussion board for students to pose questions and get help. They can also use email to send questions to the instructor. Students can attach their program so the instructor can see the program and respond.

4. Pitfalls

The technology is not without pitfalls. Some students lack the equipment needed for class. Loaner machines are available and student can rent them by the hour or by the semester. This is a stopgap measure, but it is effective when a student's computer is in for repairs.

Cheating remains the biggest concern. Electronic assignments are easy to share or steal and difficult to trace. The most-effective deterrent appears to be stiff penalties for cheating. At the beginning of the semester, students are given clear guidelines on acceptable use and clear consequences on the penalties for cheating. The biggest roadblock appears to be reluctance to enforce the policies.

More time is needed by the faculty to learn the technology and develop teaching methods to make full use of the technology. Summer development grants provided the time and incentive for this.

In class, it takes considerably more time to teach the technology before teaching the material. There are numerous examples. It takes time to show and practice zipping and unzipping files. WebCT takes considerable time to learn. Windows Journal is a great tool, but some time is needed to learn how to use it. All of these take away from classroom instruction time. It often seems that more time is taken learning the toys than in learning the material. This is true for faculty and students alike. The summer development grants are great for learning new technology, but there was no time for learning the course content or expanding an area of expertise. Students are often lost in the new technologies and have trouble distinguishing the toys from the content. These issues should dissipate as students and faculty become more comfortable with the technology.

When students have computers, especially their own, in class, the temptation to misuse them is great. It's easy to run Messenger, browse the web, check email or play games. While this could happen in a lab as well, it appears easier when the students are on their own machines in a wireless environment. They can easily go from class to class and never drop a connection. These distractions can greatly decrease their time on task.

There are paper savings with this approach, but this is not a large selling point. Estimates are that it saves only a couple of dollars per student per class in a semester. While this is important, the investment in a $1,000 - $2,000 computer to save a few dollars a semester on paper is not cost-effective!

The biggest benefit appears to be psychological. Students, faculty, parents, administration and alumni all like the high-tech approach. The new technology is cool and appeals to students. While there is a penalty for early use, it does appear that this technology will be long-standing and that it will spread to other areas. Eventually, there will be many adaptations and uses for it in business as well as education.

5. Conclusions

The use of wireless technology on campus is the next step forward in creating a connected, educational setting. Portable computing shifts the costs of computers from the campus to the students. Fair or otherwise, this shift is a reality. The use of tablets is a somewhat different approach to portable computing than laptops, but it represents an important step toward the use of ink technology and the use of digital papers. This change offers significant possibilities for students preparing for the workforce and for campuses to change the way they think about traditional paper-based assignments. The emergence of ubiquitous

computing offers many challenges for classroom teaching and academic honesty.

6. References

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