Using a Tablet PC to Enhance Instruction and Productivity

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1 Abstract

This paper discusses several ways in which the use of a Tablet PC by a professor can enhance instruction and productivity. A Tablet PC allows the user to enter information as they would with pen and paper, making it more intuitive than trying to express ideas involving text and graphics using a keyboard and mouse. Judicious use of the Tablet PC can enhance interaction and student engagement during class sessions, and allow professors to provide richer content to students on course web sites. The Tablet PC allows for the electronic storage of documents that include ink annotation, reducing the need for hard copies of many documents, including graded student assignments. The need to assess to what extent the use of Tablet PCs actually improves student interaction, engagement and achievement will be addressed as the University of Detroit Mercy embarks on a compulsory Tablet PC program for incoming students in September 2007.

2 Introduction and Background

Typical input devices for a traditional notebook PC include keyboard, mouse and scanner. “Digital inking” refers to an additional input mode that allows the user to use a stylus to write directly on the screen. There are some inexpensive graphics tablets that connect to traditional PCs, but the hand-eye coordination required to write on the tablet while watching a separate monitor involves a learning curve. A Tablet PC has a built-in writing tablet that allows the user to enter data with “digital ink” by using a stylus to write directly on the screen. This feature all but eliminates the hand-eye coordination problem. Slate Tablet PCs do not have a dedicated keyboard, although one may use an external keyboard as a peripheral device. They are typically used in settings where mobility is important, or the primary input mode is stylus on screen. A convertible Tablet PC combines the full functionality of a notebook computer with the built-in writing tablet. On such models, the screen typically swivels and folds over the keyboard with the screen facing out.

There are many examples of the use of Tablet PCs in engineering and computer science curricula. References [1–8] provide a sampling of classroom and laboratory courses utilizing Tablet PCs. In Fall 2006, Virginia Polytechnic Institute and State University required incoming freshman engineering students to purchase a Tablet PC. [9].

2.1 Classroom Presenter and Ubiquitous Presenter

Many of the institutions cited in these references make use of Classroom Presenter (CP), a Tablet PC application developed by Microsoft Research and the University of Washington [2]. This distributed application, first deployed in 2002, allows a presenter to handwrite notes on computer-projected PowerPoint slides. The slides and ink are broadcast to students’ computers where the students are able to add their own private annotations. The application allows for students to submit inked responses to instructor questions, and the instructor may select responses
to be displayed to the entire class. The whiteboard feature makes it possible for the instructor to add handwritten slides on the fly.

The main limitation of CP is that it uses multicast networking to broadcast the slides to the student PCs. Many routers at universities have been configured to block multicast packets, and in such cases, CP cannot be used. Furthermore, each student PC had to have the CP application installed and properly configured to join the multicast network.

In 2005, Ubiquitous Presenter (UP) [6, 7] extended Classroom Presenter to include new features. The new application uses common web technologies, eliminating the need to set up a multicast network. The web-based client-server architecture allows students to access and annotate the slides using any Internet-enabled computing device. No custom software is required for the student machines. The server generates simple HTML and some JavaScript, so all students need to use all of the features is a browser with JavaScript enabled. UP also provides a way for students who do not have Tablet PCs to submit responses from a keyboard.

3 Enhancing Instruction

There are many ways to use a Tablet PC to enhance instruction. This section includes a brief discussion of Ubiquitous Presenter and then goes on to give examples of how the author has used a Tablet PC to enhance instruction, including online video tutorials, saving the “ink” transcript from a class session, and using digital “ink” in any application environment.

3.1 Reflections on Ubiquitous Presenter

The College of Engineering and Science at the University of Detroit Mercy will implement a compulsory laptop program for incoming engineering and science students beginning September 2007. All incoming students will be required to obtain a Tablet PC, and instructors will be encouraged to adapt their instruction, using the computationally intensive environment to enhance interaction and learning in the classroom. At present, there are too few students who have notebook computers to exploit the interaction features of UP, so it is not something I have had the opportunity to use yet.

Having said that, my current teaching style makes very little use of PowerPoint, and involves frequent switching among different applications, for example Microsoft Journal, Firefox and MATLAB. Since UP is basically an overlay for PowerPoint slides, it will be of limited value for me until I learn to incorporate its use without serving up “death by PowerPoint.” Once students have PCs in class, the advantages of interactivity with UP will provide sufficient motivation to overcome this hurdle. It is easy to justify, for example, the use of PowerPoint for the interaction activities, and still vary other instruction modalities.

3.2 Online Tutorials

My motivation for obtaining a Tablet PC was a desire to provide richer content to students on my course web site. I find that there is never enough in-class time to work all the examples I think students need to see to become more comfortable applying new concepts. Providing students with static pen and paper problem solutions helps somewhat, but even after expanding the overly terse
solutions found in instructor solution manuals, students often find it difficult to appreciate the process of solving the problem when presented with the full solution all at once. My goal was to create dynamic presentations of problem solutions by recording the screen and my voice as I solve engineering problems by writing directly on the computer screen.

I saw two main advantages to this approach. First, the amount of additional guidance that can be provided on the audio track is much richer than could be captured on paper. And second, students are able to see the problem-solving process as it unfolds rather than as a finished product.

Camtasia Studio, a product of TechSmith, allows one to record screen activity with narration, edit the resulting video clip, and then produce the clip in a high-quality format suitable for viewing on the web (Flash). The video clip may be produced in such a way that allows easy integration with some Course Management Systems, including Blackboard.

The Tablet PC was chosen to produce this content because it takes too long to create equations and graphics on the fly with only a keyboard and mouse. The digital inking made it possible to use the tablet much as I would a whiteboard. Using Camtasia Studio, I captured the screen activity as I solved a problem, and recorded my narration of the process as I went. Camtasia Studio then allows me to produce the recorded video clip as a Flash object, embedding it in a web page that can be uploaded to the course management system. A screenshot of one of my very first online tutorials is shown in Figure 1.

![Figure 1: Screenshot of Flash Tutorial](image)

I also discovered an unanticipated benefit in that students can stop and replay selected sections of the clip, or can skip the parts they understand well, giving them more control over the learning process.

### 3.3 Transcript of Class Sessions

The Tablet PC can also be used during class sessions in place of a whiteboard, allowing the instructor to provide students with a record of everything that was written on the screen. I came upon this use of the Tablet PC quite by accident after I had left my whiteboard pens upstairs in my office one day. Students encouraged me to use the PC connected to a projector instead of the...
whiteboard. They also requested that I save the document and make it available to them on the course site to supplement the notes they took in class. Figure 2 contains an example of this application. This Figure shows a portion of a screen from a class session in a Control Systems course, created using Microsoft OneNote. The appearance of a session captured using Microsoft Journal is essentially the same as that of a OneNote session. Figure 2 was generated before the switch to Journal. Further discussion about the relative merits of these two applications is provided in Section 5.

There is another advantage to using the Tablet PC in place of a whiteboard. Consider the case of a complicated example during which it becomes necessary to erase some of the previous work to make room for the concluding steps of a solution. With the Tablet PC, it is not necessary to erase anything. I can always scroll up or down in the document to display various parts of the solution. Furthermore, suppose I run out of time in class when we are near but not yet at the end of a complicated problem solution. In my pre-tablet days, I would have had to use a few minutes of the next class meeting just to recap what we had done in the previous class, and then finish the solution. Now when faced with this situation, I go back to my office, put on my headset, start up Camtasia Studio, and record the rest of the solution to post on the course site.

3.4 Digital Ink Anywhere

Recently a new Tablet PC application called WriteOn [10, 11] has been developed to allow digital inking on a virtual screen transparency without the requirement of using an application that supports digital inking. This allows me to display, for example, a MATLAB script or an Electronic Workbench schematic, with annotations to highlight important information (see Figure 3.) WriteOn also allows the capture of the screen with the ink annotations so that this information can be provided to students on the course web site.
4  Increasing Productivity

Paperless grading of submitted reports can increase faculty productivity. The digital inking feature in some applications, such as Word, allows the instructor to write comments in the margins of papers just as she would have on a hard copy, but without printing out a single page. In addition, the graded paper can be saved by the instructor as documentation for outcomes assessment without standing in front of a copy machine making copies of graded reports. Keeping track of and organizing notes taken during meetings also has the potential to increase faculty productivity when notes are taken on the Tablet PC instead of on loose sheets of paper. Actual gains in productivity depend on the user creating a file structure on the computer that facilitates finding relevant information. A lack of organization in storing digitized information is analogous to an increasingly large stack of papers “to be filed” piling up on one’s physical desktop.

Microsoft Journal provides a printer driver that allows one to print any document to a Journal document. This feature can be used for highlighting and annotating any document that is available electronically. It has allowed me to store marked-up copies of journal and conference papers, thus eliminating the need to print them out and carry them with me on trips. Figure 4 shows how I used Journal in the coding of interview responses for some qualitative research I am

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conducting. Doing the highlighting electronically rather than with paper and highlighting markers allows me to easily send the coded transcripts to my colleague in the Education department.

Microsoft OneNote also allows inserting a document as an image into a notebook for markup but the result is different. In Microsoft Journal, there is a one-to-one correspondence between the pages in a document and Journal pages. In OneNote, a multiple page document is reproduced one page after another on the same OneNote page. This can result in awkward page breaks when printing or publishing to PDF.

5 Discussion and Next Steps

As noted above, the University of Detroit Mercy is implementing a compulsory Tablet PC program for all engineering and science students beginning their studies in September 2007. This means that the full range of options discussed in this paper will be available. Because interactive class settings are known to improve student learning, I will use Ubiquitous Presenter with the first group of students who participate in the compulsory Tablet PC program.

Using OneNote to create the record of a class session had proven to be problematic, because at present, the university computing labs do not provide this application, and very few students with their own computers have it. There is not currently a free reader for OneNote. Making the notes accessible to students required the additional step of creating a PDF document from the session transcript. Microsoft Journal, an application that comes with the Tablet PC operating system, provides a similar interface for creating handwritten notes. Journal’s main advantage is that Microsoft provides a free Journal viewer for download from its web site. This viewer runs only on Windows platforms.
With the new Tablet PC program, students will all have a copy of OneNote installed on their machines. Thus, OneNote merits a second look. One of OneNote’s features is the ability to open a shared session in which multiple users may work in the same workbook. This has the potential to increase collaboration as well as in-class interaction.

As with any technology, the danger exists that a preoccupation with the Tablet PC itself might detract from the content learning taking place in a course. It will be important as we proceed to assess whether or not student access to this resource in the classroom will increase student engagement with the course content and result in enhanced achievement of course and program outcomes.

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