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TEACHING BRIEF

Using the Tablet PC for Instruction

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In late 2002 the first Tablet PCs were unveiled. The unique feature of these PCs was that they allowed the user to write on the screen with a stylus in addition to using a mouse. Since their introduction reviews of Tablet PCs have been mixed (Bishop, 2003). Many reviewers and users have questioned whether the novel features provided by the technology are really useful enough to justify the higher price of the machines for typical users (e.g., Shaw, 2005). In this brief, the potential benefits of the Tablet PC for instructors are analyzed.

WHAT IS A TABLET PC?

A Tablet PC is a laptop that permits user input directly to the screen (using a stylus) as well as allowing for an attached keyboard and mouse. The underlying operating system, MS Windows XP Professional for Tablet PC, will run any standard Windows software. It also features a number of built-in applications, such as handwriting and voice recognition, that offer even more input flexibility. Included with the operating system is MS Journal, an application that supports drawing and other digital ink-based activities. Furthermore, a number of applications—most notably MS Office 2003—come with embedded support for ink-based annotations.

Tablet PCs come in three distinct form factors, summarized in Table 1. Support for wireless networking (802.11b) is part of the Tablet standard, so all come equipped with a built-in wireless adapter, as well as a standard network adapter.

The Tablet PC's capabilities make it uniquely suited for a number of activities that are impractical on the desktop. The ability to use the stylus to draw makes it a powerful tool for multimedia content development—graphic designers have always preferred stylus-based input (using a digitizing tablet) to the traditional mouse. Its form factor (slate and convertible models in particular) makes it an excellent tool for reading electronic copy; because it is normally used in portrait mode (as opposed to landscape), entire pages of text are quite legible. It is also relatively easy to annotate documents, because recent versions of MS Office products (e.g., MS Word 2003) allow digital ink to be written over text. Ink-to-text conversion, available in all Tablet-enabled applications, also makes it possible to search handwritten content just as if it were text. Indeed, a new MS Office product—OneNote—has been developed specifically to take advantage of the Tablet's capabilities for moving between handwriting and text in order to keep collections of handwritten notes organized.

Table 1: Tablet PC form factors.

Type	Description	Advantages	Disadvantages
Slate	A pure tablet, with no keyboard or mouse External keyboards may be attached, or a docking station can be used	Lightweight Small form factor Longest battery life	Least suitable for general use Require docking station or external devices for desktop use Processors tend to be slow No boilt-in CD drive Many types of ports not available
Convertible	A tablet that can be transformed to a laptop by rotating the screen	Best compromise: both an adequate slate and an adequate laptop Form factor comparable to many high-end notebooks	Heavier than slate Processors tend to be slow Most susceptible to mechanical failure Most expensive No built-in CD drive in many models Many types of ports not available Battery life can be problematic
Tablet-enabled laptop	A pure laptop that supports writing on the screen (a retractable stand is provided to hold the display at an appropriate angle during writing)	Least expensive, can be used as general, purpose PC Processor comparable to typical laptop More ports, built-in drives Stand makes it optimal for lectures	Heaviest Not as suitable for tablet apps that benefit from portrait mode

Many of the Tablet's unique capabilities make it highly suitable for instruction-related activities. The remainder of the brief will examine some of these applications, a number of which hold particular promise for distance learning.

RAPID MULTIMEDIA DEVELOPMENT

The Tablet PC can be a boon to multimedia content development. The technology is particularly powerful when combined with an animated screen capture software, such as the Camtasia Recorder component of Camtasia Studio (details at http://www.techsmith.com). Since I began using the Tablet (in mid-2003), I have created over 100 hours of classroom content using the following approach:

- The original content is developed in a suitable application, such as PowerPoint, MS Word, or WordPerfect. The specific source does not matter, as long as it has the ability to print.
- The content is printed to MS Journal. This procedure is identical to that of printing to Adobe Acrobat (or to a fax modem), but produces a Journal note (.jnt) file.
- An animated capture window is set up (e.g., using Camtasia Recorder) in a suitable area of the MS Journal document that was created by printing.
- The instructor lectures into a microphone, annotating, or drawing (as appropriate) in the capture window. Upon completion the capture file is saved as a multimedia file.

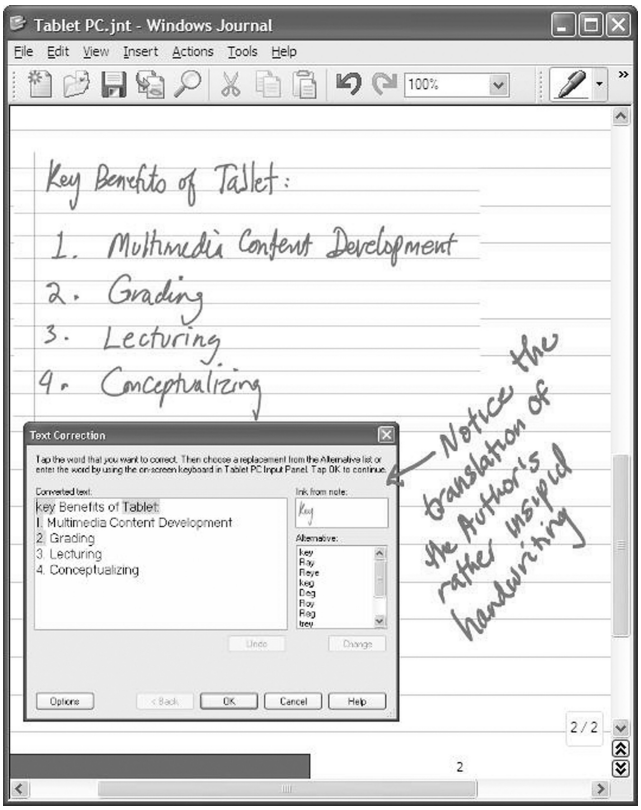
When the captured file is loaded into a media player (e.g., Windows Media Player or Real Player), the instructor's voice and all the activities that occurred while he or she was talking are replayed. The result is a presentation that is far more visually engaging than a voice-over of a static PowerPoint slide, yet no more work to create. It should be added, in this context, that a similar process can be performed on a regular PC—using an application such as Acrobat instead of Journal. The difference lies in the range of annotations that are easily added in the Tablet. Indeed, a blank Journal page can be used exactly like a Whiteboard, as suggested by Figure 1.

GRADING

Another area where the Tablet PC outperforms its desktop and laptop counterparts is in grading. A standing joke in the information systems field is that every time we create a new tool to move us toward the paperless office (e.g., graphic displays), we create another (e.g., laser printers) that ends up generating more paper. The Tablet, however, can dramatically reduce the need for paper as a result of three characteristics (applicable primarily to slates and convertibles):

- Its portrait mode of display is far better suited for display electronic paper than a monitor, which displays in landscape mode. To further facilitate reading, MS Word has introduced a new display mode—"Reading Mode"—that uses special fonts and layout to increase onscreen readability.
- The pen and ink capability provided by MS Word 2003 makes writing comments on a Word document as easy as scribbling them on hard copy.

Figure 1: Demonstration of MS Journal.



In addition, the stylus can be turned upside down and used like an eraser, allowing for complete elimination of markings that later need to be retracted. This capability frequently proves to be valuable when grading longer submissions—where thoughts and analysis that appeared to be missing sometimes surface later in the document. Longer comments can also be added using voice recognition. Older versions of MS Word can view inked comments created with the Tablet, meaning students can read them when they are returned without special software. Graded work can also be printed to Journal or Acrobat when it is to be returned.

- A Tablet PC can easily be used in many positions and locations, just like a pad of paper or a stack of assignments. This reduces the need to grade while sitting at a desk in front of a monitor. Furthermore, the wireless adapter built into all Tablets makes it possible to download and return assignments from anywhere with an accessible wireless network.

Using a Tablet can also reduce the risk of misplaced assignments, as the instructor can retain electronic copy as long as needed.

As an experiment, in fall 2003 I allowed my students in one graduate course to submit project assignments (typically over 10 pages in length) electronically or

in printed form. The electronic submissions proved so much easier to grade that, in spring semester 2004, the rule was changed so that all submissions had to be electronic—either in MS Word or .pdf format. What makes this particularly worthy of note is that the class was *not* a distance-learning class, so the choice was made entirely based on the instructor's convenience.

LECTURES

The same capabilities that make a Tablet PC a superb platform for multimedia development (e.g., the ability to draw and write) can also be used in lecturing. The Tablet, however, offers three advantages over a chalkboard or whiteboard: (1) it is easier to write on and erase, (2) lecture slides can be annotated as the instructor lectures, and (3) all Tablet contents can be saved, should students want copies. In addition, applications such as Camtasia Recorder can be used to stream screen content over the Internet, much like a Web cam.

Unexpectedly, the Tablet-enabled laptop proves to be the best of the three form factors for ease of use while lecturing. The retractable stand holds the display at a comfortable angle for writing and it does not require the instructor to remember to bring an external USB keyboard.

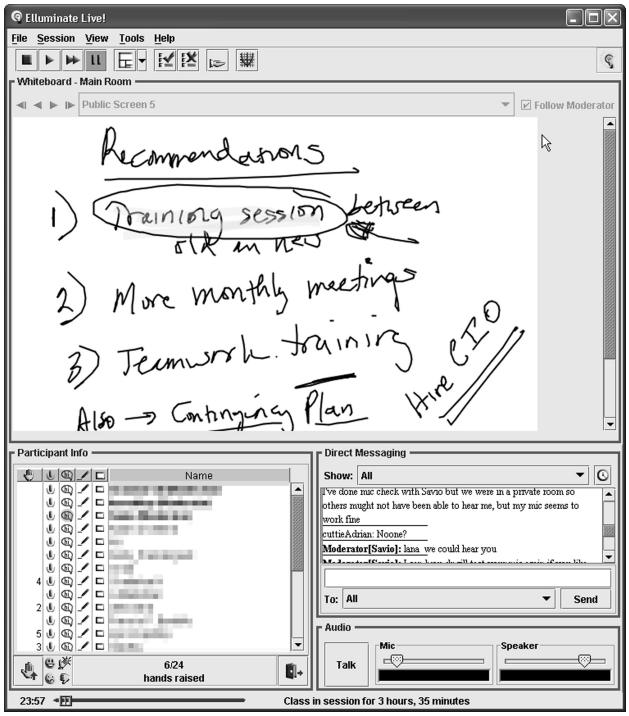
COLLABORATION

The most recent area where Tablet PCs have shown great potential is in collaborative activities—peer to peer, distance learning, and in the classroom. One peer-to-peer collaboration capability, as an example, was introduced in MS OneNote 2003 Service Pack 1 (July 27, 2004). It allows users to create an ad hoc network where they can share and edit notes synchronously. This feature offers considerable promise for facilitating small-group discussions and assignment preparation—in situations where students have access to Tablet PC technology.

In the distance-learning context, Tablet PCs offer unparalleled flexibility in sessions where a shared whiteboard is used. For example, I have experimented with conducting synchronous case discussions using Elluminate (a synchronous voice communication tool). In this context, the Tablet PC was used to organize the discussion on the shared whiteboard (see Figure 2) in the same way that a chalkboard would be used in a classroom discussion. The success of the experiment was indicated by the fact that 17 of 19 students (surveyed anonymously) voted to conduct a second online class later in the semester and the same 17 agreed the online session provided an effective learning environment (11 strongly agreed, 6 moderately agreed).

When students (as well as the instructor) have access to the technology, Tablet PCs show considerable promise for enhancing collaboration within the classroom itself. The Classroom Presenter, developed at the University of Washington (Simon, Anderson, Hoyer, & Su, 2004), provides the lecturer with all the previously described "Lecture" capabilities and adds functionality allowing students to write their own inked annotations and send them to the instructor in real time. The instructor then can decide to display (or not display) these on the main projection screen. In using the tool in teaching programming classes, instructors have found

Figure 2: Online case discussion whiteboard (using Elluminate).



Note: Names and identifying information obscured.

particular benefits in conducting complex/rich problem-solving exercises (where illustrations or diagrams often clarify text) and in the initiation of spontaneous classroom activities. The ability to control the anonymity of student responses was also noted as being useful in encouraging participation from shy students. Ubiquitous Presenter, a tool which extends the capabilities to non-Tablet student participants using a browser interface (Wilkerson, Griswold, & Simon, 2005), has also been developed.

CONCLUSIONS

Did the Tablet PC fail to gain immediate widespread acceptance in industry because it was designed primarily to meet the needs of academics? Whatever the reason, after having used a Tablet for 2 years, I would never voluntarily go back to a standard desktop or laptop. Creating multimedia content, grading, and lecturing have all become easier since I acquired the first of my Tablets. Even more abstract tasks, such as conceptualizing research and course design have been enhanced. Rather than using a pad of paper and sketching out thoughts, those thoughts are now written in OneNote where—unlike a pad—I can erase them cleanly, move them around to reorganize them, add extra lines to the middle of a page when I discover I forgot something, and convert the thoughts to text for pasting into other

Table 2: Tablet PC effectiveness, rated by task.

Activity	Benchmark Tool	Slate Form	Convertible Form	Tablet-Enabled Laptop	Comments/Justification
Multimedia content development	PC	Slightly better	Better	Better	Drawing capability and MS Journal are very useful. Slate can move to "better" ranking with docking station.
Grading	Hard copy	Better	Better	Slightly worse	MS Office 2003 allows writing (and erasing comments). Used in portrait mode, away from the desk, electronic grading easier than paper.
Lecturing	PC	Slightly better	Slightly better	Better	Ability to draw and save screen, available in MS Office 2003 and Acrobat, turns PC into whiteboard. Tablet-enabled laptop most suitable because keyboard is available while drawing. External keyboards can be used for other form factors.
Conceptualizing	Legal pad	Better	Better	Worse	Journal and OneNote provide all the benefits of a pad of paper, while also offering clean erasing and organization. Weaknesses of Tablet-enabled laptop are its lack of portrait mode and a form factor best suited to a desk.
Note taking in meetings	Legal pad	Better	Slightly better	Worse	Similar to conceptualizing, except power chord tends to be needed, unless meetings are short. Slate models tend to boast slightly longer battery life.
Communications tasks, wireless available	Laptop	Slightly better	Better	Same	Built-in wireless and slate form factor make email and Web browsing easy to do from anywhere (chair, couch, table). Convertible offers advantage of being able to access keyboard when longer text must be entered.
Communications tasks, wireless not available	Laptop	Slightly worse	Slightly better	Same	Advantages of slate form factor reduced when network cable must also be connected.
General PC tasks (e.g., writing, spreadsheets)	Laptop	Worse	Slightly worse	Same	Tablets tend to be less powerful and require a lot more external devices be connected. They also tend to operate at lower screen resolutions. Tablet-enabled laptops, in contrast, are pretty comparable.

applications or emailing to colleagues. I can also find the notes that I sketched out a few months ago—something I could never do when pads of paper were my medium of choice.

My assessments relating to the suitability of the different Tablet form factors for various academic tasks are summarized in Table 2, based upon my experiences using a Toshiba 3500 (convertible) and an Acer 250 PE (Tablet-enabled laptop) for each of the described tasks.

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