

Using Tablet PCs as a Teaching Tool in the CM Classroom

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The educator who wants to take advantage of technological advances in the classroom is presented with a plethora of options ranging from interactive whiteboards to clickers. One option that is showing promise is the use of tablet PCs which allow the instructor to write directly on the computer screen and electronically capture a presentation. Tablet PCs are especially useful in technical courses that involve figures, diagrams and mathematical problem solving. Studies have shown that, when interactively coupled to computers in the hands of students, tablet PCs can have a positive effect on learning. Other studies, however, indicate that without sound curriculum design and teaching practices, the introduction of technology may actually have a detrimental effect on learning. The instructor who is looking for a tool to improve the delivery of a course in a classroom setting, but is not prepared to invest the time and capital to make a wholesale curriculum change, may choose to simply add the tablet PC to his or her set of tools. This paper aims to provide some tips and guidance to help an instructor efficiently and effectively make this addition.

Key Words: Tablet PC, Classroom Technology, OneNote, Teaching Tips

Introduction

Technology in one form or another has been utilized in the college classroom for as long as there have been classrooms. An early example of assistive classroom technology is the use of chalk on slate blackboards. As classrooms are remodeled and new classrooms are built, whiteboards are replacing blackboards to serve the same purpose. Overhead transparency projectors have been utilized to display information, with the distinct difference of turning the instructor around to face the students and allowing the integration of prepared materials. With the advent of computer technology, these overhead projectors have been supplanted by computers and video projection systems that can display digital material. A study published in 2007 revealed that the top six technologies currently in use at that time were “the overhead projector, the VCR, a slide projector, the Internet, a large screen video data display and an instructor computer workstation” (Brill, 2007, p. 98). In addition, digital document cameras allow for the projection of content from paper media. Technologies such as student response systems (also known as clickers) have been developed to assist in engaging students (Yourstone, 2008). Other technologies such as interactive whiteboards use computer technology to display and capture information and provide a medium for interaction with digital media. These whiteboards are typically installed permanently in a classroom and work in concert with a dedicated computer and video projection equipment. Tablet PCs can be used to emulate an interactive whiteboard and add flexibility at a lower cost. In general, the widespread use of new technologies lags their initial introduction into the classroom for obvious reasons: it takes time for educators to learn how to use the tools, it takes a great deal of effort to adapt curriculum materials to new tools, and there are financial barriers to surmount. Courses that deal with graphic and technical material, such as those found in a typical construction management curriculum, benefit most from the use of these technologies.

The instructor who is looking for a tool to improve the delivery of a course in a classroom setting, but who is not prepared to invest the time and capital to make a wholesale curriculum change, may choose to simply add the tablet PC to his set of tools. This paper aims to provide some tips and guidance to help an instructor efficiently and effectively make this addition, specifically with the use of Microsoft OneNote as the primary organization and presentation software.

Rationale and Background

Various studies (Anderson et al., 2004; Enriquez, 2010; Kemp, 2007; Lowerison et al. (2006b); Weitz et al., 2006) have concluded that the use of technology in the classroom has a positive, albeit limited, effect on student learning.

Lowerison et al. (2006b) studied 1834 undergraduate and graduate students using a survey and found a small but significant positive relationship between how often technology was used and course evaluations. However, others conclude that the design of the curriculum has more of an effect on learning than the technology itself. For instance, changing presentations from a title and bulleted list to an assertion followed by supportive visual evidence can lead to significant improvements in areas of retention, exam scores and discussion quality. This change in method may help move from a teacher-centered to student-centered environment (Kahn, 2007).

While there is limited concrete evidence of the effectiveness of technology in the classroom, there is evidence that learners believe the technology is beneficial (Guthrie & Carlin, 2004; Lowerison et al., 2006a; Lowerison et al., 2006b; Mock, 2004; Shuell & Farger, 2001). Surveys of faculty perceptions also support this belief (Brill, 2007; Kemp & Jones, 2007; Lowerison et al., 2006; Senjo et al., 2007; Weitz et al., 2006). Wang and Woo summarize that “[t]he primary factor that influences the effectiveness of learning is not the availability of technology, but the pedagogical design for [its] effective use.” (Wang & Woo, 2007).

Tablet PCs used in conjunction with video projectors allow the instructor to use his own handwriting (termed ‘inking’ in many software applications) alone or superimposed on prepared diagrams with the added advantage over the whiteboard of being able to record the notes electronically for later distribution. Surveys indicate that students pay more attention, understood material better, and would like to see tablet PCs used in more courses (Mock, 2004). Weitz (2006) reports that 90 percent of instructors who used tablet PCs believe that they impart a positive value on the teaching and learning in their classrooms. Anecdotal information suggests that this technology is much better for presenting complex diagrams (Hulls, 2005; Kemp & Jones, 2007) as it gives instructors more flexibility for innovation (Wood & Ashfield, 2008). Recent research on the use of tablet PCs in the classroom indicates that there is a positive learning effect when the teacher and students use interconnected computers and interactive software (Enriquez, 2010).

Resources

Hardware

As of this writing, new tablet products are coming on the market at a rapid pace. All tablets fall into two categories of design: slate and convertible. Convertible tablets appear similar to a notebook pc, but allow for the screen to swivel 180 degrees so that when closed, the display is on top. Slate styles differ from convertibles in that they do not have a lid and lack a physical keyboard. Tablets are available from a variety of manufactures and at a variety of levels of quality and size. Most include a few programmable hardware buttons to access such functions as volume, screen scrolling and display settings while in tablet mode. Input on the screen is accomplished via a writing stylus (or “pen”) that is typically pressure-sensitive. Most styluses have a hardware button that can be programmed, while tapping and pressing-and-holding the pen to the screen can also be programmed to simulate different mouse clicks (tapping usually defaults to a left click while pressing-and-holding defaults to a right click). Many products also incorporate a touch-sensitive screen that does not require the use of a stylus. It is difficult, however, to be precise using the finger as an input device on a touch screen. Generally, tablets can be categorized as consumer quality, professional quality and rugged. Consumer quality tablets are typically constructed with generic parts to keep costs down. Although one can purchase an extended service plan to cover potential failures, the down-time associated with service and data loss may not be worth the cost savings. Professional or business quality tablets typically cost more but are more reliable and are therefore preferred. Rugged tablets cost considerably more and tend to be bulky and heavy, but may be the right choice for rough environments. To be functional in the classroom, the tablet must have the capability to run the desired software (see detailed discussion below) and be able to connect to an external display. Unless the tablet will be used as a primary computer or for highly demanding processing (e.g., graphics rendering), the computer need not have a fast processor or extensive memory. In fact, the most desirable qualities after reliability are portability and battery life. Solid state memory (SSD), for instance, utilizes less energy than a mechanical drive, and is therefore desirable. A wired and/or wireless network card is necessary to access files stored on a network or if connection to the internet is desired.

The second essential piece of hardware is a digital video projector. Most instructors have access to digital projectors, either portable or fixed in a classroom. It is important that the projector has the power and resolution appropriate for the classroom size. Newer projectors support network connection similar to printing devices; however the user may

experience some lag time and connectivity issues, especially if working over a wireless connection, so a hard wire connection is recommended.

It is important to have a comfortable lectern that allows for natural writing on the tablet. The lectern should be located at a place in the room that provides the best visual contact with the students. Although projection systems are sometimes available in the classroom, the location of the connection ports for network, video and audio may not be optimal, thus long extension cables (25 or 50-foot) may be necessary.

Software

The scope of this discussion is limited to tablets running Microsoft Windows operating systems (OS), although other operating systems do support tablet functionality. The Windows XP OS requires a special tablet version to activate pen features, while Windows Vista and Windows 7 have tablet functionality integrated into all versions.

The most versatile and readily available software for use with the tablet PC is the Microsoft Office suite of programs (versions 2003, 2007 and 2010). Microsoft OneNote in particular incorporates organizational structures, network file accessibility from multiple computers and a variety of presentation tools. OneNote provides a free-format canvas upon which text and graphics can be placed using the standard tools found in most word processing software packages (e.g., pasting images, creating geometric shapes, creating blocks of formatted text, etc.). In addition, the stylus can be used as a pen to write directly on the screen to add words and drawings (dubbed 'inking' – see figure 1.) Color and line-weight palettes allow the user to use multiple styles to create effective diagrams and figures. Handwritten words can be converted to actual text with amazing fidelity (after some training) using the handwriting recognition routines native to the software. OneNote provides a robust search engine that will find and highlight words throughout a notebook, section or page. The search even includes hand-written words that have not been converted to text. The 2010 version of OneNote incorporates some functionality with touchscreens and collaboration not found in earlier versions, however it has a reduced ability to create and place custom toolbars around the perimeter of the screen. OneNote is part of the Professional Academic suite from Microsoft, thus it is usually available to instructors through institutional contracts or at deep discounts from Microsoft. In addition, when OneNote is installed on a computer, a special print device ("Send to OneNote") can be added to the list of available printers that facilitates sending output from any software directly to OneNote environment (note that this functionality is not available in OneNote 2007 on 64 bit operating systems).

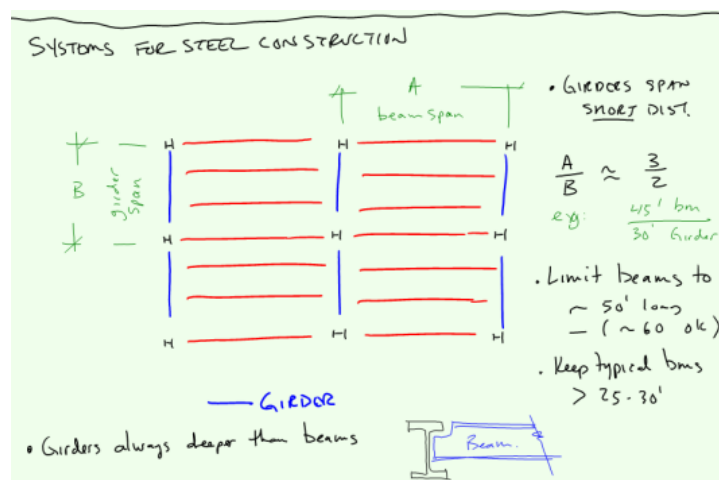


Figure 1: Example of 'Inking'

The standard word processing software from Microsoft, Word, also allows for 'inking' directly on documents however 'inking' often activates image and graphic editing controls, so the user may end up accidentally moving items in the background, thus potentially causing confusion. 'Inking' on PowerPoint works well, but functions best when using the 'presenter view' that allows the presenter to see notes and controls on the native screen that are not visible on the external display.

The professional version of Adobe Acrobat is available to most academics at a reduced cost and does have ‘inking’ and highlighting functionality when working with portable document files (PDFs). Highlighting and scrolling works well, however there is significant lag between the writing action and the appearance of the line-work while ‘inking’. There are also problems with ‘inking’ resolution (writing too quickly can result in straight segments instead of curved lines) and the inability to create a ‘dot’ (the natural action of dotting an ‘i’ doesn’t work). For these reasons, presenting with Acrobat is recommended only in instances when the instructor is displaying a PDF file and simply highlighting or circling important information. Note that PDF documents, or portions thereof, can be copied or sent directly to OneNote.

In addition, there are commercial and open-source software packages (DyKnow Vision Classroom presenter, Ubiquitous Presenter) that are designed specifically for the classroom setting. They provide student response system functionality and allow students to connect via their own computers to follow along and make notes on top of the ones presented by the instructor. They also allow the instructor some control over the student’s machine. While very functional, they are best suited to classrooms in which all students have access to a laptop, or preferably a tablet. Note that these applications can be used stand-alone in a similar fashion as the Microsoft software listed above.

In general, the pen or touch on a tablet PC functions like a mouse, therefore, any software that has drawing functionality can efficiently utilize the pen functionality of the tablet PC.

The use of live screen and audio and video capture software, such as Camtasia, can provide a way for the instructor to ‘record’ a class electronically for later archiving and distribution. Recording and publishing can be used to assist students with studying, provide a lecture to students who cannot attend the class and to develop modules for future on-line delivery. The use of a professional quality microphone is highly recommended if audio capture is desired. Video capture (of the instructor in front of the class) is best accomplished using a high definition video camera that is operated by a second person. Note that the recording of class sessions requires extensive file storage and distribution capacity.

Strategies and Methods

Organization

It is important to develop an organization system to store the information that is prepared and captured on the tablet PC. It is useful to create template files for use from semester to semester or across multiple sections of a single course. One of the primary advantages of using the tablet PC over a fully preformatted slide show presentation (using, say PowerPoint alone) is that the students can watch the information evolve, hopefully promoting cognitive processing. Further, the tablet PC can slow down the pace of a class. One complaint of slide show presentations is that too much information is presented in too short of a time. When solving statics problems in a structures course or closing a level loop in a surveying course, for instance, it is more effective for students to watch the calculations progress than to see them presented in a final form. At the end of a class session, it is desirable to save the graphics that have been created. While a simple file structure utilizing a pre-determined naming convention will serve this purpose, OneNote provides an excellent alternative. Within OneNote, information is organized by ‘pages’, ‘sections’ and ‘notebooks’ (see figure 2). Notebooks are actually stored as file folders by the operating system, while sections are single files with the extension ‘.one’ within those folders. These folders and files can be accessed, copied, moved and renamed through the operating system file management interface as well as within the OneNote environment. Information is saved real-time (like in a database) so there is no need to explicitly save work. When stored on a network resource, the information can be accessed from any connected computer that has OneNote installed. This, incidentally, allows for multiple users to see (and collaborate) on the same ‘pages’ simultaneously.

A suggested organization structure for course material within OneNote is presented in figure 2. ‘Notebooks’ are created for each course, ‘sections’ for each class (e.g. each semester or section) and ‘pages’ document each class meeting. OneNote allows for the creation of templates which are useful to setup the default look of a ‘page’ (e.g. font type, size, headings, etc.). Templates thus created can be assigned as default for a notebook, automatically loading when a new ‘page’ is created.

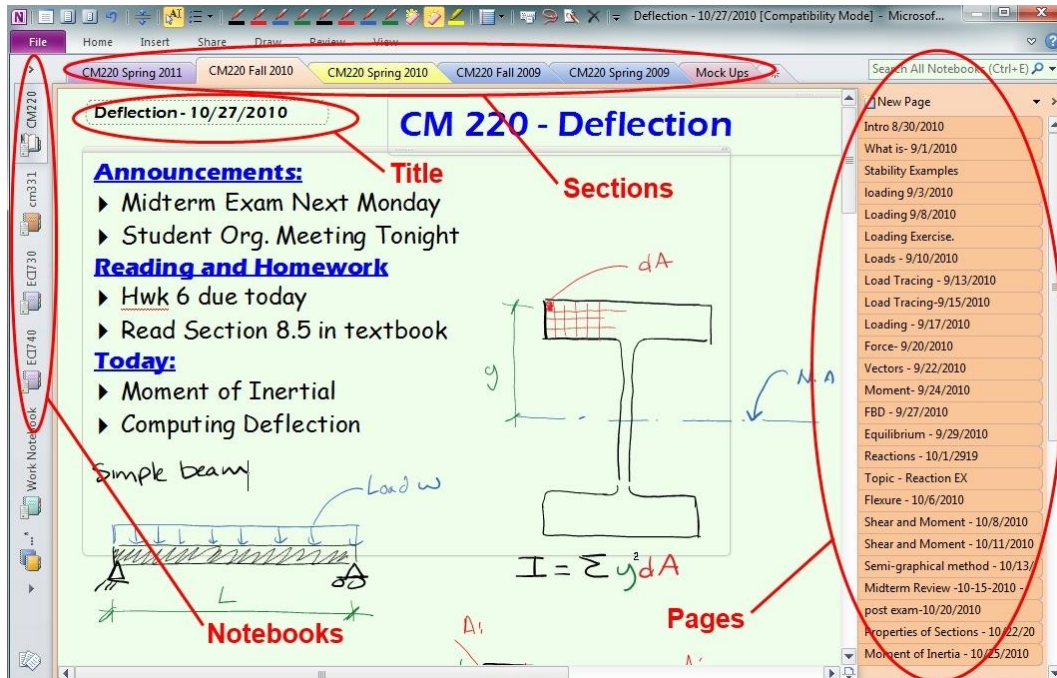


Figure 2: Layout of the OneNote screen

Recommended Logical Steps for Using the Tablet PC and OneNote in the Classroom

While it is acknowledged that everyone works differently, what follows is a workflow that the author has found to be functional for teaching structures and surveying courses. It is widely agreed that traditional didactic lectures are less effective in promoting learning than ones that are interactive and learner-centered, so it is important not to let the tablet PC limit or undermine good teaching practices. Unless a commitment has been made to provide a complete record of the material delivered, the instructor should not hesitate to abandon the tablet PC and utilize other media or methods when appropriate.

Step 1: Create a template. A default template can be associated with each notebook. The template will provide a consistent appearance from day to day and will provide prompts for course preparation. In figure 2, the headings “Announcements”, “Reading and Homework” and “Today” as well as the title and date are part of the template layout. Note that the text contained in the box at the top left-hand corner (“Deflection – 10/27/2010” in figure 2) automatically becomes the page title shown on the tabs to the right. The use of a ‘topic – date’ format for page titles makes it easy to browse previous class sessions.

Step 2: Preload the page when preparing for class. Using the template created in step 1, fill out pertinent general information (e.g., daily announcements, homework assignments and daily objectives) and pre-load any content in the blank space below prior to class. Be careful that the width of the content is not wider than the display capacity of the classroom projector. Leave space between graphics in anticipation of any writing that will be added during class. If a class requires extensive preloaded content, copy it to a separate section prior to use in class so that it will be ready for subsequent presentations. This is especially important if multiple sections of the same course are to be delivered.

Step 3: Connect to projector, power and network. Be sure to do a dry run prior to using the tablet PC in a new classroom as every hardware and software combination is idiosyncratic and may require some troubleshooting to function as desired. The Windows 7 OS provides many tools that assist in setting up the hardware (found within the ‘windows mobility center’). Turning on the ‘presentation settings’ will disable the screen saver and will allow an alternate desktop background to be displayed. It is desirable to place the computer on

a lectern centered in the room and so an extension cable may be necessary to make display, audio and network connections.

Step 4: Teach Class. Once set-up, the tablet PC can be used as a virtual whiteboard, for showing prepared presentations, for displaying content from the internet and for any other computer applications needed in the classroom.

Step 5: Create Record of Class. Save the ‘page’ from OneNote in publishable format (e.g. PDF) and publish to learning management system or other file sharing location.

Tips for Effective Use of OneNote as a Presentation Tool

The following tips are intended to provide guidance to the instructor who is interested in using the tablet PC as a presentation tool in the classroom. While most features are available in all versions of OneNote, when there is a difference between versions, tips will be preceded by version number (e.g. OneNote 2007).

Toolbars: OneNote 2007: activate the ‘MyPens’ toolbar and create an additional custom toolbar and populate it with frequently used tools. Place these toolbars along left and bottom margins. OneNote 2010: Customize the “Quick Access” toolbar and populate it with frequently used tools. The following tools have been found to be useful by this author: commonly used pens, pen gallery, eraser, insert writing space tool, lasso select, text, full screen, rule lines, common shapes and convert handwriting to text tool. Similar toolbars can be created or modified in other Microsoft products.

Options: Editing - Set the default text size to 24 point and select a sans-serif font that displays well on a projector. Pen – Enable “use pressure sensitivity” and ‘scratch-out gesture while inking’ functions. While the top of some styluses can be used as an eraser, the scratch-out gesture (scribbling back and forth horizontally) is an efficient way to correct mistakes while presenting.

Writing: Write slowly and concentrate on neatness. Do not cram information onto a single page and utilize the ‘insert writing space’ tool to add (or remove) space between existing graphics or text.

Figures and calculations: Turn grid lines on when drawing figures and tables. Develop a color scheme (e.g. green for dimensions, black for objects, red for forces) that utilizes multiple colors to add depth. Vary pen weight as appropriate to provide depth to drawings.

Display: Use 75% zoom setting. This allows for a finer differentiation between the different standard pen widths. Zoom in when working on specific detailed graphics and zoom out when reviewing to show more content.

Preparation: Present information in an organized fashion. Remember that the tablet PC is only a tool and won’t fix problems associated with poor teaching practices.

Useful keyboard shortcuts: Windows + s will allow you to capture part of the computer screen and will insert it into OneNote. Windows + v will disable pens (pressing windows-v again will enable). This is an undocumented feature and can cause panic and headaches if it inadvertently happens. Windows + p brings up the control used to connect to an external display.

Tablet PC Use Outside the Classroom

Outside of the traditional classroom, the tablet PC is a useful tool for the educator. The ‘inking’ functions can be used when reviewing and commenting on electronically submitted assignments, thus requiring fewer hard copy submissions. In the on-line teaching environment, this functionality provides the instructor with a useful tool not only for grading but for delivering synchronous instruction via virtual whiteboard functionality inherent in most learning management systems. The tablet PC, especially when equipped with a touch-sensitive screen, also functions as a convenient electronic document reader allowing the researcher to read, take notes and file digital documents

such as journal articles. Note that the professional version of Adobe Acrobat is required to access functions that allow for commenting, repaginating and optical character recognition.

Feedback from Students

Student comments have been positive regarding the use of the tablet PC in construction management courses in structures and surveying. Among 157 course evaluation responses since 2009, 9.5 percent included unsolicited positive comments regarding the use of the tablet PC by the instructor in the classroom while there was no negative feedback on its use. Some students commented that they enjoyed the experience and thought it was effective in helping them learn. Many commented on the usefulness for reviewing material and doing homework. For example one student in an introductory structures course said “I really like the use of the tablet PC for notes. When I was lost on the homework I could go back and see how the instructor worked through the problems.” Supporting the effectiveness of its use in the classroom, another student in a steel building design course commented that “[the instructor] has a way to convey [sic] the information in that class that I have not been able to find in any other professor. I feel as though his style of teaching (Tablet PC) is very effective and gives us a chance to listen and participate rather than worrying about missing notes the whole time.”

Conclusion

When used properly, the tablet PC and video projector are superior to the traditional whiteboard in many ways. The instructor can face the classroom while teaching and can use electronic media seamlessly and interactively with hand written notes and diagrams. Graphics and writing can be permanently captured, either statically, dynamically or both. Material that was previously presented can be easily recalled to the screen. When set up with proper lighting and projector, the writing and graphics can be clearer and easier to read. Additional benefits include avoiding nuisances associated with dry-erase markers.

Of course there are downsides to using the tablet PC in the classroom. The problems most often encountered by this author are technical in nature, including the loss of network connectivity, battery power or display connectivity, or PC hardware and software malfunction. However, as the instructor develops a routine, many of these issues become less problematic. It is always important to have a backup plan (e.g. stashed dry erase markers) for those inevitable occurrences. Depending on the classroom equipment, the whiteboards may have much more ‘real estate’ that will allow for students to visually see more of the material at a given time. If the classroom does not have a fixed projection system there is the added inconvenience of arranging, transporting and setting up projection equipment. And, of course, one must carry the tablet computer to every class.

While no technology will save poor teaching procedures, good methods can be improved by utilizing technological advances that are now available. Research supports the use of technology that actively engages students in the classroom, however, some suggested implementations require extensive capital outlay and curriculum redesign. For the instructor who already utilizes engaging approaches in the classroom, the addition of a tablet PC may be an attractive way to improve a course. It can improve student interest, provide for a clearer medium for delivery of visual material, and allow for the capturing of content that is created in the classroom.

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