Teaching with Technology
Volume 2: The Stories Continue

Towards the Paperless Class

Corey Angst and Jon Crutchfield

I have been transitioning from paper-based teaching to digital teaching for years, incorporating not only increasing amounts of electronic documents, web pages and web videos, but also requiring that students take exams (all of mine are essay-exams) on a computer. The last remaining obstacle was the textbook. While my primary textbook has been available digitally through the web browser, the student experience was not adequate (Hannon 2008).

Note: although co-authored by Mr. Crutchfield, this essay was written from Professor Angst's perspective.

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Background

In March of 2010 the Office of Information Technologies (OIT) formed an ePublishing Working Group and invited me to participate, along with a variety of other people at Notre Dame. Each of us had a distinct interest in the transition from print materials to digital. The purpose of the group was to examine the ePublishing "ecosystem" on campus. Several meetings were spent discussing a pilot study, but the tipping point came with the introduction of the Apple iPad tablet computer and its support for the ePub standard. During the summer of 2010, OIT issued a call for action: did any faculty members in the group want to initiate a pilot to more deeply examine ePublishing? I recognized this as a chance to both achieve my paperless class and also gather data for my research on how people adopt and adapt to technology.

I volunteered my Project Management course as an opportunity to, 1) evaluate the effectiveness of a multi-function eReader in and out of the classroom, 2) see how the introduction of the eReader impacted the University (i.e. impact on IT support, infrastructure, etc.) and 3) establish an entirely digital course. OIT offered to fund 50% of the cost for the 16 GB Wi-Fi tablets and cases if we could convince other groups to fund the remaining 50%. Four groups stepped up and OIT committed to lead the technical implementation of at least one course pilot for each of the funding partners during the 2010-2011 academic year.

Approach

Students in my Project Management course take on "real world" projects sponsored by Notre Dame and other organizations (for profit and not-for-profit) in our region. These consulting projects give students an opportunity to apply the project management principles they learn the class. As part of the course, I help students become aware of advances in technology that can aid in the successful management of their projects. Introducing iPads was a natural extension of that learning goal. Mobile devices are becoming ubiquitous in society and students must be proficient in their use if they wish to be successful. It was difficult to predict what the learning outcomes would be, but I fully anticipated that students would invent ways of using the tablets to improve their own engagement in the course.

I was also keenly aware that I could not mandate how students would use the tablets. This was based on an experience two years earlier, when I introduced an online collaborative environment and saw very low usage rates over the course of several weeks. When I finally asked why, the students said they loved the idea of the tool but that it was far too bulky and inefficient. I had strongly encouraged them to use this specific tool, but they chose a different one. It allowed them to experience working online in a collaborative environment, which was the intended goal. With the iPad experiment, I wanted students to actively engage with me on how the device could be used to collaborate beyond the obvious ways, such as email.

OIT and the Hesburgh Libraries conducted extensive research to help me determine the best way for students to access out textbook on the tablet. In the end, the only apps that worked were 1) *CourseSmart*, where the textbook was only accessible when connected to Wi-Fi, and 2) *VitalSource*, which let students store the book on their device. I ultimately chose *CourseSmart*; it provided the best highlighting and annotation features … and VitalSource was not available at the beginning of the course.

I contacted all students before the semester started and told them they would have the opportunity to participate in an iPad pilot, but were free to decline. The content of the eBook was identical to the physical book and students were given the option to return the tablet at any point in exchange for a printed book. The student response was unanimous and enthusiastic in support of participation. We were concerned about possible accessibility issues for students with disabilities, but no one indicated a need for accommodations. Therefore, while the iPad has some accessibility features, we did not test them.

I gathered data from the students at multiple points during the semester and employed the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh, et al. 2003) and other scales to assess various perceptions held by the students. The UTAUT model holds that there are indirect factors which moderate most of the direct determinants of the intention to use technology, and some which moderate the direct determinants of technology use behavior.

Students completed four surveys over the course of seven weeks: before picking up the iPads, two weeks

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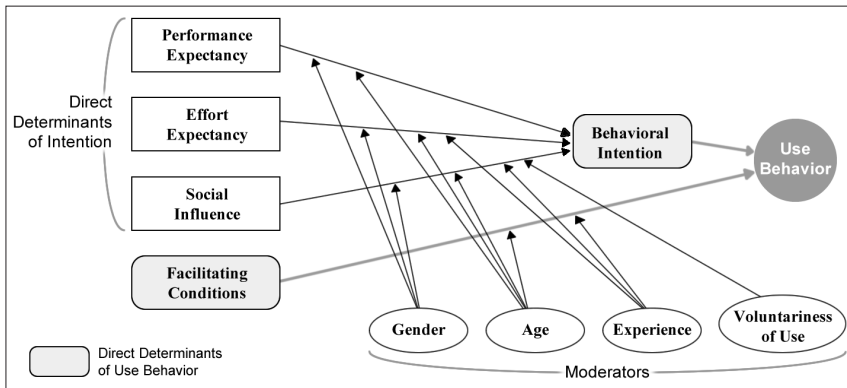
At Left: UTAUT Model

surveys and focus groups we learned students did have very high expectations initially, but there was very little decrease throughout the time students used the tablets – this was true even though students reported high levels of dissatisfaction with some functionality.

after the course started, one week before the end of the course, and two weeks after returning the tablets. We also had two focus group sessions at the end of the course with a total of eight students participating.

OIT developed a process for configuring the iPads with security, network, and email settings. Their Academic Technologies group met with each student individually to ensure they had a properly configured and working device. Academic Technologies also provided basic training on how to use the physical features of the tablet, access email, and use a browser. Students understood the iPads were only being loaned to them, but were encouraged to use them as much as they wanted for academic or personal reasons, including syncing with an iTunes account.

I set up a Google Site for students to share questions, concerns, problems, solutions, tips, favorite apps, etc. I also dedicated the first part of the first class meeting to talking about the goals of the pilot, appropriate use of the devices, and walking through the process of purchasing the textbook. I encouraged students to bring the tablets to class every day and I required them to complete a short-answer quiz using the tablet several times throughout the course. Students used the tablets as much or as little as they saw fit for their consulting projects.

Other professors participating in the pilot used the tablets in a variety of ways. In a freshman level course on contemplation students used them for journaling, sketching, and recording audio reflections outside of class. A professor in the law school used an online polling service to gain instant, honest feedback from students on their feelings regarding moral and ethical issues during in-class discussions.

Results

With new technology implementations, it is not uncommon for expectations to be high initially, fall dramatically as users realize all the limitations, then gradually rise again as they learn how to work around or accept the limitations. Through the

Students immediately recognized collaboration benefits when using tablets to support their consulting projects. Many students took their iPads to meetings with clients during which they took notes, searched for information on the Internet, and shared material with clients, including visual mock-ups of solutions. The tablets enabled students to leverage a common hardware and app platform to simplify and speed up information sharing. Students realized that apps like *Dropbox* simplified collaboration and used them to replace email as the primary method for distributing files to team members. Students researched, installed, and used apps on their own to accomplish specific assignments like creating a Mind Map™ and Gantt chart.

Students also discovered "found time" with the tablet. Because the iPad was quick to turn on, fast to unlock, convenient and did not need to be charged throughout the day, students reported reading and responding to email more frequently between classes. I have taught the Project Management course for several years. I frequently send emails to students, asking them to read a current news article or watch a short video clip that relates to a current topic being covered in class. In past semesters a handful of students would come to class having read or viewed the content, but the tablet seemed to make it easier to comply with my requests. Students also reported that they were much more likely to use the tablet to gather additional information about a topic being discussed during class or take notes because it was less obtrusive than a laptop and created less of a physical barrier between me and them.

I found a way to use the iPad that improved how I graded student presentations as well. I used *iAnnotate PDF* to open the student presentations and used a stylus to write questions to ask the group and comments about the content and the presentation. Finally, I would put a grade on the presentation and use *Dropbox* to distribute the marked up, graded presentation to the group – often before they made it back to their seats. I am convinced that the immediacy and directness of the feedback improved the quality of the feedback I gave the students.

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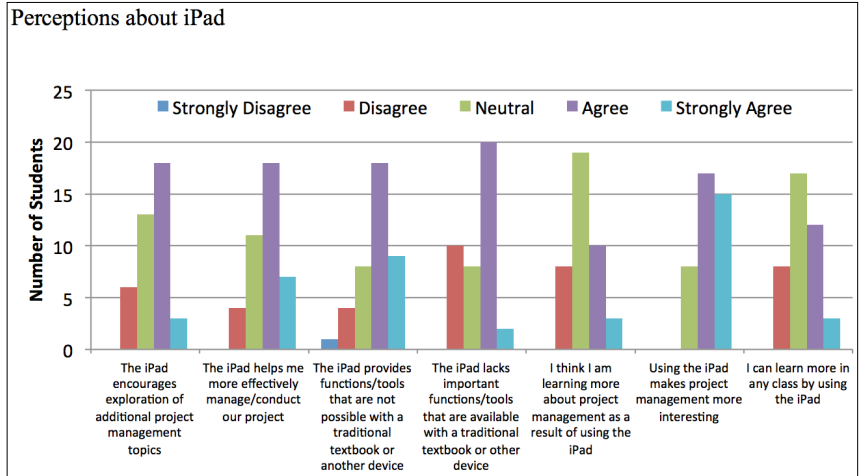Here is a sample of student quotes from the surveys and focus groups.

Everything [is] on one device [that is] smaller than many books.

It is obviously helping avoid unnecessary paper waste, but it also opens up a lot of possible collaboration that didn't exist with the normal textbook set up.

I am more organized and my backpack is certainly lighter since I don't need to carry my laptop and cord everywhere. I also LOVE the long battery life.
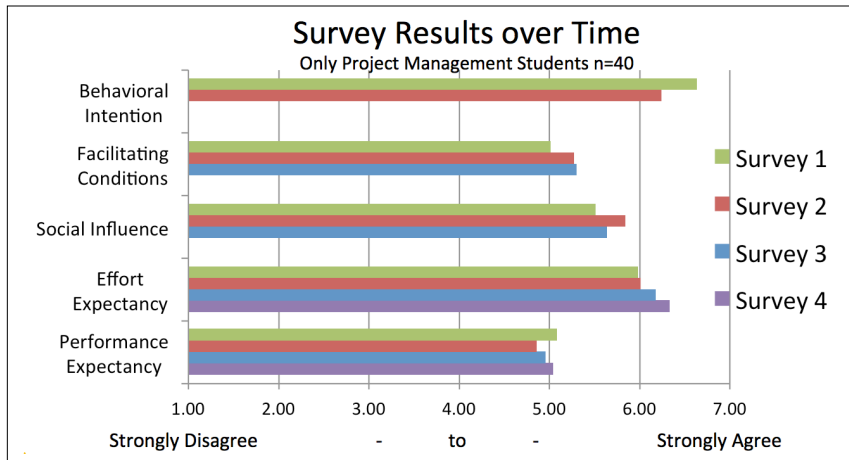
Instant information at your fingertips.

As noted earlier, I was also collecting perceptual data that attempted to tap into the beliefs students had about the value of the tablet. Results showed that a statistically significant proportion of students felt the tablet, 1) makes class more interesting, 2) encourages exploration of additional topics, 3) provides functions/tools not possible with a textbook, and 4) helps students more effectively manage their time. Other results are reported in the charts below.

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Perceptions about iPad

Takeaways from the data summarized above:

1. The students perceive that the iPad encourages exploration, allows them to more effectively manage a project, provides additional functions (but also lacks important functions), and makes project management more interesting.
2. Even in this admittedly small sample of 40 students, the means of all but items 5 and 7 differ significantly from the neutral response.
3. While not statistically significant, the majority of students said they were learning more by using the iPad.

Recognizing some of the limitations of this kind of research, we wanted to capture additional information from the students beyond what surfaced in survey responses and in-class discussions. Therefore, we conducted focus groups at the end of the semester, which allowed us to gain further insights. Most of my students were seniors, and during the focus group sessions they told us they did not want to change how they studied, because they had adopted tools and techniques over time that made them successful students. Interestingly, they noted that they would have modified their behaviors had they been given the eReaders as freshman since they had to adapt their study habits from high school as they began college. Many students said they also would have gotten more benefits from the tablet had they owned it rather than borrowing it – they did not want to spend money on apps and accessories because they were giving the iPads back after the course.

The textbook markup experience and the method of handling files were the primary sources of student dissatisfaction. Highlighting and annotating the book through the *CourseSmart* app was much more cumbersome than with a printed book. Students also reported that flipping back and forth between locations in the digital book was difficult. Unlike other computers the students use, the iPad does not expose

Survey Results over Time
Only Project Management Students n=40

Takeaways from the data summarized above:

1. Expectations were high due to the incredible hype surrounding the release of the iPad, but performance appeared to live up to the hype.
2. Usefulness (performance expectancy) was very consistent throughout the entire study and did not wear off even after the iPads were returned, suggesting this was not a transient effect that went away when students went back to the traditional way of working.

the file system. Students were unable to search for a file they wanted then open it, for example. Students had to learn to first open the app used to create or access the file. Many students installed *Dropbox* as a way to address this challenge. Several students also reported concern because none of the apps had a "Save" button. Even though they knew the tablet was continually saving their work, they missed the comfort of actually pushing a button and having the option of reverting to the previously saved version. In the end, the students noted two reasons they would be hesitant to buy their own tablet: 1) they were seniors and their future employer would provide technology, and 2) they saw the tablet as an addition to (not a replacement for) the smartphone and laptop they already own, so there would be no cost savings.

Recommendations

This experiment afforded me a wealth of knowledge about introducing technology into the classroom that would not have been possible without the pilot. As a result, I have several recommendations.

- Begin searching for digital course materials well before the class starts. Not all books are available electronically and some of the publishers have proprietary reading software.
- The library is an invaluable resource in helping identify digital content and understanding copyright issues.
- You and your students will reap huge benefits if you spend time up front with the digital course materials and the apps used to access them.. Give students active guidance on how to use the device in support of the learning goals for the course. Not all students can use digital materials and tools to take notes, complete assignments, or study.
- Involve your information technology group early in the planning process. They can help with setup and provide valuable technical support, freeing you to focus on teaching.
- If the course demands specific apps or accessories (e.g., stylus), then require students to purchase the items and provide them with training.
- Transferring content to and from a tablet can be more difficult than it is on a laptop or desktop. Identify a file storage solution – on campus or cloud hosted – that works well on the tablet and show students how to use it.
- Set clear expectations for ways students should use the tablet - or not use it - during class time.

- Encourage students to explore the tablet and share their discoveries with the class – new apps, pros & cons, and tips & tricks.

In hindsight, I wish I had required specific apps beyond the one required for the textbook; most of them are very inexpensive. Several issues came up when students did not have a good PDF reader, for example. Finally, now that I am more comfortable with the capabilities and limitations of the device, I would create assignments and quizzes that required students to use the tablets.

Overall, the initial pilot was a huge success. Subsequent use of iPads in other classes has also gone better than expected. In late 2011 we will release a report detailing the findings from five other courses that used the device. In addition, the ePublishing Working Group continues to evaluate multi-function eReader tablets. Here are some questions we hope to address in the near future:

- Which specific teaching, learning and research activities do tablets facilitate?
- What accessibility issues do tablets raise and how can they best be addressed?
- How does the sustainability of multi-function eReaders compare with that of books?
- Does using a different type of tablet or newer apps affect technology acceptance?
- Are there differences between courses in student perceptions of the iPad (behavioral, perceived value, usage) ?

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iPad Satisfaction Survey

Overall Satisfaction
Describe your general feelings towards the iPad.

I loved it	33%
I liked it	53%
Mixed Feelings	8%
I didn't like it	6%
I hated it	0%

Total Votes: 36

Current Feelings
Now that you have returned the iPad, do you miss it?

I miss it a lot	22%
I miss it a little	31%
Mixed Feelings	25%
Not really	14%
Not at all	8%

Total Votes: 36

Pros and Cons of the iPad
Summary of Focus Group Discussions.

Pros	Cons
Battery Life	Annotated highlighting – not quite there
Great for games	Taking notes on device – hard to type
Portability, connectedness	Glossy screen is not the best – especially in sunlight
Consolidation – everything in one place	Very limited multitasking capabilities
Versatility – phone (Skype), text, email	Difficult to flip between pages in the text book app
Calendar on iPad more effective than on iPhone	Uncomfortable with the lack of a "save" button

References and Resources

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Venkatesh, V., M. G. Morris, G. B. Davis, F. D. Davis. 2003. User Acceptance of Information Technology: Toward a Unified View, *MIS Quarterly*. 27 425-478. Retrieved from http://socialmini09.hciresearch.org/content/venkatesh-et-al-2003-user-acceptance-information-technology-toward-unified-view

Web resources

eReader Accessibility (Ars Technica) http://arstechnica.com/gadgets/news/2010/08/for-visually-impaired-most-e-readers-barely-measure-up.ars

iPad Enterprise Deployment, including iPhone Configuration Utility (Apple) http://www.apple.com/support/ipad/enterprise/

Notre Dame eReader study (YouTube) http://www.youtube.com/watch?v=-knt89NLAY0

Image credits

iPad classroom (page 2). Matt Cashore. *Notre Dame News*, August 31, 2010. Retrieved from http://newsinfo.nd.edu/news/16552-notre-dame-s-first-paperless-course/

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The Learning Technology Consortium

The LTC began in 1998 as a partnership of institutions with similar instructional goals, strong technology and faculty support programs, and an interest in collaboration around teaching and learning with technology. The members are:

- University of Delaware
- University of Florida
- University of Georgia
- University of Maryland
- University of North Carolina at Chapel Hill
- University of Notre Dame
- University of Pittsburgh
- Virginia Tech
- Wake Forest University

Representatives meet semiannually at one of the institutions, where members tour specialized facilities and discuss the selection and use of learning technologies, benchmarking, and collaboration.

www.learningtechnologyconsortium.org