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.

Corey Angst is an Assistant Professor in the Department of Management at the University of Notre Dame. His research interests include the transformational effect of IT, technology usage, and IT value. In recent papers, he has investigated the diffusion of disruptive healthcare innovations and the relationship to financial value and quality of care. Prior to pursuing his academic career, Professor Angst worked as a consultant with the DuPont Company. He received a Ph.D. from University of Maryland and an MBA from the University of Delaware.

Jon Crutchfield is an Academic Technologies Consultant with the Office of Information Technologies at the University of Notre Dame. He collaborates with faculty, students and IT staff to identify and implement emerging technologies for pedagogical needs. Mr. Crutchfield holds an MBA from Notre Dame and previously developed innovative, customer facing web sites for Ford Motor Company.
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.

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 in 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. 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 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 after, at the end of the course, and a year after using the device.
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 mockups 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.

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
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 users use, the iPads do not expose...
Towards the Paperless Class

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)?

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.
- The textbook markup experience and the method of handling files were the primary sources of student dissatisfaction. Highlighting and annotating the textbook on the tablet was much more cumbersome than with a printed book.

iPod Satisfaction Survey

Overall Satisfaction
Describe your general feelings towards the iPod.

<table>
<thead>
<tr>
<th></th>
<th>Total Value: 36</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I loved it</strong></td>
<td>35%</td>
</tr>
<tr>
<td><strong>I liked it</strong></td>
<td>59%</td>
</tr>
<tr>
<td><strong>Mixed Feelings</strong></td>
<td>9%</td>
</tr>
<tr>
<td><strong>I didn’t like it</strong></td>
<td>8%</td>
</tr>
<tr>
<td><strong>I hated it</strong></td>
<td>8%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Total Value: 36</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I miss it a lot</strong></td>
<td>39%</td>
</tr>
<tr>
<td><strong>I miss it a little</strong></td>
<td>38%</td>
</tr>
<tr>
<td><strong>Mixed Feelings</strong></td>
<td>12%</td>
</tr>
<tr>
<td><strong>Not really</strong></td>
<td>2%</td>
</tr>
<tr>
<td><strong>Not at all</strong></td>
<td>8%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Use</td>
<td>Annotation highlighting – not quite there</td>
</tr>
<tr>
<td>Great for games</td>
<td>Taking notes on device – hard to type</td>
</tr>
<tr>
<td>Portability, connectivity</td>
<td>Glossy screen is not the best – especially in sunlight</td>
</tr>
<tr>
<td>Consistency – everything in one place</td>
<td>Very limited multi-tasking capabilities</td>
</tr>
<tr>
<td>Versatility – phone (Skype, text, email)</td>
<td>Difficult to flip between pages in the text book app</td>
</tr>
<tr>
<td>Calendar on iPad more effective than on iPhone</td>
<td>Uncomfortable with the lack of a “save” button</td>
</tr>
</tbody>
</table>
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

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References and Resources


Web resources


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
