The E-reader pilot at Princeton

Fall semester, 2009

Final report, (executive summary)

Project web page: www.princeton.edu/ereaderpilot

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Abstract

In the Fall of 2009, the Office of Information Technology (OIT) at Princeton conducted a pilot program using electronic readers (e-readers) in a classroom setting. The pilot was conducted with three broad goals. One was to reduce the amount of printing and photocopying done in the three pilot courses. The second was to determine if using this technology in the classroom could equal (or better) the typical classroom experience where more traditional readings were used. The third sought to explore the strengths and weaknesses of current e-reader technology to provide suggestions for future devices.

E-reader technology offered the promise of delivering a large number of digitized documents on a lightweight device with a long battery life, and a display that mimicked the reflective qualities of actual paper. The consumer market in e-readers had already proved it was possible to read on these devices; we sought to see if they could be useful in higher education by conducting a pilot using e-readers in several courses.

Three courses were selected for the pilot, involving 3 faculty members, and 51 students. The e-reader used in the pilot was the Amazon Kindle DX.

The goal of printing less in the pilot courses was achieved: pilot participants printed just over half the amount of sheets than control groups who did not use e-readers. The classroom experience was somewhat worsened by using e-readers, as study and reference habits of a lifetime were challenged by device limitations. This pilot suggests that future e-book manufacturers may wish to pay more attention to annotation tools, pagination, content organization, and in achieving a more natural "paper-like" user experience. In summary, although most users of the Kindle DX were very pleased with their "reading" experiences with the Kindle, they felt that the "writing" tools fell short of expectations, and prevented them from doing things easily accomplished with paper.

Summary of pilot goals

Do e-readers reduce printing?

Apparently, yes. At least they did in the courses tested for this pilot.

Most students surveyed in the Princeton pilot (94%) said they did use less paper, reducing by as much as 85% the printing they normally would have done in the pilot course. In another question on the survey, the students indicated that the pilot course had more readings than their other courses, amounting to slightly over half of their total assigned readings for the semester. In reviewing the printing figures for the semester among pilot participants and other students, it would seem at first glance, that the students were quite accurate in their self-assessments.

Printing statistics for two of the three pilot courses, WWS325 and WWS555a were studied against control groups that existed for previous and current course participants. WWS325, which had no pilot opt-outs or auditors, compared this year's printing statistics to last year's. In WWS555a, there was both an internal control group (one opt-out and 2 auditors) as well as statistics from a past offering from the course.

More interesting was the accidental fact that another Woodrow Wilson School graduate-level seminar had a high percentage (24%) of students who were also participating in the e-reader pilot. Students in that course printed an average of 1508 sheets of paper. Students who had a Kindle taking the same course printed an average of 570 sheets.[1] This suggests that there is a cumulative effect in saving paper when e-readers are used in more than one course.

A summary of the printing statistics is illustrated in this table:

Summary:

Course	Average paper use, Kindle owner	Average paper use, control group	Relative difference
WWS555a	962	1826	53%
WWS325	762	1373*	55%
WWS5xx with 24% enrollment of pilot participants	570	1508	38%**

extrapolated from Fall '08 usage of 1144 sheets per person, with 20% per annum increase

*** Kindle users in this class were well below the mean of their pilot peer group in WWS555a, apparently because they used the Kindle in two classes instead of one. There is little else to account for the difference.*

There is no control group for CLA546 because the course was never offered before. The printing data for those netids was not collected.

As a result of using an e-reader in the classroom, when explicitly asked to limit printing for the pilot course, Kindle owners printed just over half of the amounts printed by control groups.

How do e-readers work in the classroom?

When asked to rank the experience of reading — in terms of quality, quantity, speed, retention, and learning and comprehension – and how it compared to reading similar texts on paper. The vast majority of Princeton students in the e-reader pilot felt that these experiences were "about the same," although a few students felt their reading speed was significantly faster or slower. The majority of students wished more *course readings* were available for the Kindle, however, when asked if more *courses* would use the Kindle, most students were unsure, or disagreed. Several students reported that using the Kindles in the classroom was very clumsy, particularly when the entire class was trying to get to the same location in the text for group discussions. In the focus group discussions, some participants mentioned that not being able to compare documents easily, to flip through them or skim for review later in the semester, made their retention worse than usual. They cited the lack of flexibility and speed of navigation within readings as a major factor in this, as well as the inability to compare documents.

Students recognized that certain types of readings were better suited to the Kindle than others. Their favorite features of the Kindle DX were

- The battery life, the wireless connection, and the portability of the Kindle.
- The fact that all the course reading was on one device
- The ability to search for content
- The legibility of the screen, and the fact it could be read in full sunlight

The areas in which they felt the Kindle could be best improved were:

- The ability to highlight and annotate PDF files
- Improving the annotation tools
- Providing a folder structure to keep similar readings together
- Improving the highlighting function
- Improving the navigation within and between Kindle documents

Because it was difficult to take notes on the Kindle, because PDF documents could not be annotated or highlighted at all, and because it was hard to look at more than one document at once, the Kindle was occasionally a tool that was counter-productive to scholarship. As one student noted:

> *For me reading the less essential readings on the Kindle was fine but when there were readings that I was really interested in and really wanted to retain, wanted to read over and over again [it] made it a little*

> *frustrating to be doing [them] on the Kindle and for those particular readings, it would have been nice to have printed off an electronic version . . . especially when you're writing a research paper, for example.*

There were a small number of students who saw great potential in the Kindle for specific types of scholarship, for example—

> *I really want more books in foreign languages, with dictionaries — this would make the Kindle a WONDERFUL tool for reading literature in other languages*

Since the annotation tools on the Kindle were the most complained about feature, students were asked on the final survey how they'd prefer to make notes. Two choices tied for top place: these were adding notes by writing longhand with a stylus on the page with OCR handwriting recognition, and the ability to add highlights by drawing with a finger or stylus. The second most popular choice was typing notes on a better-designed keyboard than the Kindle DX's. The third was to add drawings and handwritten notes by stylus *without* character recognition so that notes were saved as an image, regardless of whether they were words, scribbles or drawings. The least popular idea was to add notes by speaking.

Other suggestions for annotation were

1. Formatting text by bold, italics or underlining
2. Having true "highlighting" features, rather than the underlining the Kindle DX provides – students often use several colors to highlight for purposes of clarity, and more options to replicate that would be appreciated. (This was the only use of color most students were interested in.)
3. Making the bookmarked and annotated pages more noticeable – so that if pages could be "flipped" quickly they'd be more visible
4. The ability to capture phrases with circles or polygons and to add some characters such as checks and stars that could be placed in the margins.

A popular feature announced by Amazon shortly after the pilot began was greeted by many pilot students as a work-around for the problems with annotation. This feature promised that all notes, marks and highlights made by Kindle owners to books purchased from Amazon were to be stored in the computing 'cloud' of the Amazon store, where they could be accessed, copied, pasted and shared.[2] Because of the difficulty of typing notes, many students had resorted to highlighting with the Kindle instead, and to linking their handwritten notes to Kindle highlights that captured the relevant part of the text. They were at first delighted with the new online feature, since highlights could be printed and correlated with handwritten notes, pasted into a word processor and edited, or shared with

classmates to facilitate classroom discussion. It was also a great time-saver for capturing paper citations. This feature was used heavily until students discovered that less than 10% of the book could be highlighted in this way – sometimes as little as 7% of the book's total content. Hence, the highlights students had already made simply vanished. This caused a lot of frustration among pilot participants. Several stopped using the annotation tools completely at that point, except when they needed to grab a paper citation. Otherwise, they felt it was time wasted to make notes that could not be retrieved, particularly since there was no indication that one had exceeded the publisher's limits on highlighting for any particular book. For those students who highlighted less extensively, the "notes-in-the-cloud" feature remained popular.

What features do e-readers need to be effective tools for higher education?

From an institutional perspective, it is important that future models of e-readers should include accessible features for a broad range of potential users. It is clear from the student feedback that their concerns were with more immediate issues, such as the present layout of the Kindle keyboard and other ways of interfacing with the device. One thing that emerged clearly from the surveys was that superb annotation tools are critical for the success of an e-reader used in higher education. There was some interest in readers that had more functionality (such as access to a word processor, hence the ability to read and write at the same time). There were also functional concerns, such as the ability to compare documents, or have more than one reading open at a time, and some ability to "skim" or "flip" rapidly through a reading to see highlights and notes. In those areas, the features are similar to those in which the students thought the Kindle might improve, as mentioned in the section above.

There was a strong positive attachment to some present feature of the Kindle DX, most particularly the reflective screen, which allowed for long periods of reading, the size, the form factor, and the battery life. When told that any additional features (such as a color or LCD screen) would impact battery life, most students said they preferred to stick with grayscale and e-paper technology – with one exception: highlighting, where more contrast to the page, and a variety of possible marking styles would help create the same effectiveness as color highlighters on a black and white paper page. Many users thought that the addition of a touch screen and stylus would make for a much better device.

When asked to summarize their desire for the perfect e-reader, many students pointed out that they already owned computers, and that reading effectively required a different set of features. The statement "The perfect reading tool would . . ." was completed by students in the following ways:

- *Be like the Kindle, but have a touch screen and easier to use annotating devices.*
- *Mimic the experience of reading a paper book, and allow me to put notes in the margins and highlight just as I would with a "normal" book.*

- *Would simply be like a conventional book, but paperless. I would prefer not even noticing that I am using an electronic device to read. Too many features simply make an e-reader a computer, which we already have. Having said that, some features, especially navigation tools, are very important just because without them, the reader cannot go through pages of a book the way one can do on a paper book. When using books as sources to write papers, navigation is extremely important. I usually take lots of notes on the books/articles that I am planning to cite. And when writing, I just go back and forth.*
- *Allow me to import books as well as upload my own relevant documents, with minimal editing capacity, and a long battery life. Ability to move easily through e-book*
- *I like the idea of having a device that is just for reading (email, music, etc. is not important because other devices do that, and then the e-reader becomes more like a computer). It makes commuting and traveling much easier to know that you have everything with you. I also found that it really did save paper for me.*
- *I'm not really that interested in browsing the web so I would prefer a device that focused on making reading and annotating work well rather than on other features.*

An opportunity to add final statements to the survey elicited this plea:

- *Don't attempt to turn e-readers into mini-computers. I already have a laptop that I love, and since I'm a student, I hardly do any of my course reading "on-the-go," which means that if I'm going to lug this device around with me somewhere, I do not want a second computer to lug around. 2) Touch screen is essential – for people who like to annotate with a virtual keyboard or by stylus for longhand. 3) Have to get color highlighting/underlining. 4) Device must be faster – turning pages took forever and I really missed being able to skim.*

In short, students were very positive about the "reading" aspects of the present crop of e-readers when compared to paper, but felt that the experience of writing and studying could by vastly improved by better input tools, by having color available for highlights (but not necessarily for the page being read), and by allowing a way to skim visually or flip through the readings, in a way that was more analogous to using paper. They felt an e-reader that could accomplish these tasks would be a welcome addition to their lives as students.

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[1] One student in this course had requested that PDF readings for this course be adapted for his Kindle. He shared the files with the fellow Kindle owners in the second class. The Kindle owners who participated in both this seminar AND the pilot seminar were among the most conservative paper users in the entire pilot.

[22] This service is available at http://kindle.amazon.com