Professional paper

iPad: A New Classroom Technology? A Report From Two Pilot Studies

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Summary

In this paper we discuss two pilot studies involving the use of iPads for active reading in a teaching/learning situation. This is part of a broader study of how introducing tablet PCs may transform the work and learning practices of learners. One of the pilot studies was conducted in a graduate level course, involving 40 university students. The other study involved 26 fourth grade elementary schoolchildren. The results concerning acceptance of the technology were vastly different in the two studies. We find the comparison to be very interesting in several aspects, most notably on the issue of ownership and perceived usefulness. We hope that our experience with these pilot studies may be of use and interest for a wider community. Our research method is based on ethnography (in-class observations), enriched by workshops, questionnaires, group and individual interviews involving students, faculty and, in the case of elementary schoolchildren, families. The data from interviews has been consolidated and mapped out into an affinity diagram. The resulting diagram shows clearly issues that should be further addressed, as well as areas where changes in study-related work practices may occur. This paper offers some reflections on differences and similarities observed in the two study situations.

Key words: Classroom Ecology; iPad; Learning; Mobile Technology in Classroom; Tablet PC; Technology Adoption; Touch User Interface.

Introduction

A system consisting of students, teacher, practices, values and technology may be referred to as classroom information ecology (Nardi, 1999). Our interest was to observe how introducing a tablet, in this case an iPad, would change that ecology. Unlike more traditional 'desktop technologies', mobile technology like

tablet PCs may be easier integrated into the daily life of students. It also has the potential to redefine what constitutes a learning space. Without constraints of specific time and place, it may facilitate more robustly situated learning practices. Whether this hypothesis holds true needs to be verified in real life situations. Many educators world around are aware of this potential and there are many studies that are being conducted around the globe testing this or a similar hypothesis (see (Hu, 2011), (Chen, 2010), (Wilson, 2011) or (White, 2010)). In (Vollen, 2011), Danish IT paper, it is reported that the rector of the school conducting one such experiment in Denmark has said: "It does not sound nice, but we'll see if we can claim a larger portion of students' free time. The path to learning is now shorter. Students may, whenever the opportunity arises, read school related texts or watch a videotaped lectures in the comfort of their sofa in the evening." (Trans. Culén). However, scientific studies on the effect of iPad-based learning are yet to come.

An opportunity to conduct the two pilot studies in a real learning situation arose in the fall semester of 2010, when the University of Oslo Library decided to try out a digital curriculum on iPad, and equipped an entire Geology class (40 students and their instructor) with iPads. In the spring semester of 2011, some of these iPads were used in an elementary school study. The goal of the studies was to see how students adopt this new technology and how does it influence the classroom ecology. The first pilot study was also part of the (Green University, 2010) project with focus on the environment. The use of paper and the volume of printing was the primary measure of possible environmental benefits of using iPads in the class.

The Geology class was chosen without any special considerations as to how iPad could be used in that field. However, placing an entire course curriculum on the iPad at no expense for students, alongside of environmental benefits of less printing, was viewed as something that would increase the perceived usefulness of the tablet for students. In addition, iPads are generally viewed as devices that have an easy to use, intuitive interface. In (Davis, 1987), the influence of perceived usefulness and perceived ease of use are discussed in relation to acceptance of technology. Many other variables have been relevant to the technology acceptance model (TAM). In (Barki et al., 2007) the authors name: trust, cognitive absorption, self-efficacy, job relevance, image, result demonstrability, disconfirmation, information satisfaction, top management commitment, personal innovativeness, information quality, system quality, computer anxiety, computer playfulness, and perceptions of external control as some of the factors that may be important for the acceptance of technology. Our findings show that while many of the above showed up in the course of the study, ownership and the possibility of sharing the work on iPad have been the most important (Culén et al., 2011). However, at the end of the pilot study we could only conclude that the introduction of this technology had not been a success with the Geology class. The disinterest of students in this platform for work purposes is illustrated

by the fact that all of the students were offered the opportunity to buy the iPads that they used throughout the semester at a favourable price, but only 3 students took up the offer.
On the other hand, the results of the second pilot study show that the iPad has been successfully introduced as a tool at an elementary school. As an indication of how important the iPads were for children, we can quote one of the fourth graders who participated in the study: "*the best things we ever had at school are iPads and chickens"* (they have incubated some eggs and watched the chickens get out of their shells in the second grade).

Context of Pilot Study 1
Forty students, 1 lecturer and 3 teaching assistants participated in the study in the fall of 2010. Each iPad had the class curriculum downloaded in advance. The curriculum for the course consisted of book chapters, lecture slides, maps and academic papers. Each iPad came with a Dropbox containing the curriculum. The students have also received a gift card of approximately $25, and were required to get iAnnotate and Elements applications from the Apple Apps store which would enable them to add their own annotations, highlight the text etc. No stylus or cover for multi-positional viewing of iPad was given to the students. The physical setting for this course was typical for higher educational institutions countrywide. Students have lectures in a large auditorium and discussion/work groups in small groups and rooms. Wi-Fi is available everywhere at the University premises, but student housing, where many international students from this class lived, did not have Wi-Fi, thus disabling iPad Internet use while studying at home. Their program is very competitive and fast paced, thus leaving students with little time for anything else but studies. The students have signed an agreement to participate in our study, and committed to participation in one workshop and two surveys.

Context of Pilot Study 2
Six iPads were given to a class of 26 children: 1 for the teacher and 5 for the children. The study began in January 2011 and will last for one year. At the end of the first semester, we could report that the iPads have been successfully integrated into the classroom ecology (Gasparini et al., 2011). The schoolchildren use a spacious classroom, equipped with a Smart Board, laptop (usually connected to the Smart Board and used exclusively by the teacher) and three stationary PC's for student use. This is standard equipment for classrooms at this school and a common setting for other elementary schools countrywide. There was no Wi-Fi connection in the classroom; wireless mobile broadband was installed for the purposes of this study. As the iPads were also to be taken home, it is relevant to note that all participants had a wireless network at home and access to either a PC or a laptop. The children are 4th graders (aged 8-9). They are technologically savvy (see (Buckingham, 2007) and (Druin, 2009) on facets of

children's involvement with technology). The authors of this paper had used this same class in a previous study (Culén et al., 2011) involving the children in the co-design of an e-book reader interface. A digitized curriculum is not yet common in elementary schools. However, access to a digitized curriculum was obtained from the academic publisher (free of charge) for Religious Studies, Mathematics and Science. English is relevant both as a school subject and as the language of the applications. The children have some knowledge of the language, but many are far from fluent. The traditional way of teaching English was supplemented from the start of the study with stories and Apps that could help children to improve their English through play. No restrictions were imposed on what they could download and how they could use the tablets in their free time. Each iPad had an iTunes account with $25, with no required purchases. The children were left to make a financial decision: if they wanted more expensive Apps, they could join forces and pay for them as a group, or find other ways of managing the funds. Each iPad came with a Dropbox containing the curriculum books and the iAnnotate application, which enables users to highlight the text, make notes, etc. The children, like Geology students, were not given a stylus or a cover for multi-positional viewing (see Figure 1). The parents of the schoolchildren have signed an agreement giving us permission to conduct surveys, workshops and short interviews with children at school. Two families have agreed to be interviewed in their homes.

Figure 1. Students received an iPad each, the schoolchidren one iPad per group of five children.

The Method

The main method was based on ethnography. We were aware of technology adoption assessment questions such as those in (Staley, 2004). In Pilot Study 1, graduate students of informatics worked with students of geology during the semester. The students of informatics observed the use of iPads in the classroom, carrying out a contextual inquiry, and also doubling as technical support.

Additional data was collected from two surveys, one workshop and three group interviews (2 interviewers per group and 4-6 participants). After the end of the course, 3 students and the instructor were interviewed individually. All interviews, group and individual, were recorded and transcribed. The interview data was consolidated using the sticky notes method (one observation per note) to map the observations into an affinity diagram. The analysis pointed towards ownership and cooperation as new and interesting variables to consider in relation to mobile technology adoption in education.

In Pilot Study 2, for the first weeks of the study, we followed the grounded theory procedures (Sharp et al., 2007; 388) and simply observed the ecosystem, waiting for participants' main concerns, challenges or areas of mastery of something new to emerge. The children were observed in the class every Tuesday. The researcher also provided technical support. In addition, we conducted two workshops, interviews with two families (including students), as well as one with the teacher. Data was collected using audio, video, notes, photographs and periodic collection of iPads in order to view and document the content. Many informal conversations during the observations were very valuable. Some quantitative data was collected through four short surveys (each comprising 1-5 questions). The data was analyzed and categorized similarly as in Pilot Study 1. The analysis indicated three variables of particular interest: use of the iPads for creative learning, attitudes towards learning, and the emergence of new social patterns.

Organizational challenges

This set of challenges addresses issues around the premises on which the iPads are distributed (short term loan, long term loan, owning) to students, how the content is acquired and later accessed, who is to provide the support, and when.

In both studies, participants are "borrowing" iPads for a given length of time (one semester for students and a whole year for schoolchildren). In both cases, technical support was made available to all participants. Both students and schoolchildren needed support of various kinds, most notably with equipment breakdowns (one iPad stopped working completely, but many participants experienced temporary problems when iPads were not shut down for a long time). The students needed a tutorial on iAnnotate (YouTube, 2010); the elementary schoolchildren were given one hour of introduction to iPad at the beginning of the semester, and once a week they could get help with whatever problems they had, most often with the wireless network connection and with download of Apps as well as some guidance on how to use them.

The most important variables that were directly, but only partially, related to organizational challenges were:

- Perceived intuitiveness and the ease of use of iPad
- Perceived ownership

General perception that touch user interfaces (TUIs) are natural, intuitive etc., was falsely extended into thinking that applications would be equally easy to master by graduate students. However, they needed guidance on the use of the basics they got with the iPads, such as Dropbox and iAnnotate. The students felt that learning all these apps "properly" would take too much time. Therefore, in order to make them more willing to set the time they need to get used to working with iPads, a tutorial for iAnnotate was made (YouTube, 2010). All of this was perceived as rather complicated to use, in spite of the fact that the TUI itself was found to be very easy by majority of students.

The children, on the other hand, were not under time or academic pressure. They were interested in exploring and found it not to be difficult at all. Thus, for the level of tasks they were performing, they found the iPad to be easy to use, intuitive and playful. It is perhaps interesting to remark that arrangements around sharing of the 5 iPads among the children have gone without any problems and were fully self regulated. They have never complained about someone doing something on the iPad they did not like (such as removing content they placed on it).

When it comes to ownership, a more detailed report may be found in (Culén et al., 2011). It suffice to say that the schoolchildren live "in the now", and the timeframe for which they could use the iPads did not weigh on them. Neither were they concerned with the destiny of their work stored on iPads. They are happily unaware of many aspects of the ownership issues, and this variable was of no importance for them. Quite a different picture is seen when it comes to students. Again, part of the problem could be resolved by organizing the terms of the loan of iPads to students in a different manner (as was done at Stanford University (Hussein, 2010)), but other ownership issues, such as proprietary (Apple) software or ownership of annotations made on PDF files and stored in the cloud, would still persist.

Challenges due to physical environment

In this category, findings were also quite different. Students have quickly found out that taking notes on iPads is hard, not only because iAnnotate is difficult to master, but also, because their physical space is limited to a chair with a small work surface, which is insufficient for holding an iPad, a book and some paper and pencils. They were much happier with use of iPads in smaller discussion rooms with tables, where they could share images and texts from their iPads. Apart from this, as aforementioned, the availability of Wi-Fi on iPads was limited to the University, thus forcing the students to use devices that could be connected to the local area network by wire.

When it comes to elementary schoolchildren, the adjustments and changes in the physical environment they had to make due to the number of iPads they got (the classroom was now organised into 5 large work areas, one for each group of children with an iPad they could jointly use) fostered collaboration and

sharing, and increased the interactions among the children. They had also the only Wi-Fi equipped classroom in the school (enabling increased use of the internet in class). The Wi-Fi did not work perfectly, but everyone was very patient with it, indicating that the benefits outweighed the problems.

Academic challenges

When a new device is put into a classroom use, it naturally changes the way students work. In Pilot Study 1, we found that time pressure and the need to obtain a good grade in the class were factors that prevented students from making much time to explore the possibilities that iPad offers. Their field has a strong tradition of how the things are done. Students often resorted to these traditional means (please see the Survey2_Geology, 2010) thus missing the benefits of some features iPads offer. For example, none of the university students searched the curriculum on their iPads for specific themes or concepts, or shared their own notes taken during the lectures via email or Dropbox.

In Pilot Study 2, the challenges concerned the selection of appropriate educational applications that could adequately supplement the teaching, a common theme for many of the studies concerning the iPad in education.

It is well known that the role of the teacher in acceptance of new classroom technology (see for example (Baylor et al., 2002)) is very important. The teachers in the two studies were providing different role models for their respective students:

- The University professor has a well-established course, with a long tradition, and learning to use an iPad efficiently would take a lot of time: "*When I have very long working days and I want to be as effective as possible, the effort of sitting down for 2 -3 hours to learn the iPad is too great for me"*. (Trans. Culén). He did not use the iPad when teaching.
- The elementary school teacher used the iPad actively every day during classes for variety of tasks.

Technological challenges

These challenges were of much greater importance to students and they have given a long list of frustrations, some of which are:

- Two applications cannot be open at the same time (for example, it is not possible to follow the lecture slides and browse at the same time). Students are used to multitasking in this field.
- Reloading pages or slides in PDF format takes a very long time (for example, if the text references some figure that is on a different page, it can take a considerable time to find the figure; similarly when zooming on a figure, which Geology students often do, it may be slow to reload).
- Downloading files was difficult for many students.

- No support for Flash.
- Problems with 3D viewing.

Some of the challenges that emerged during the course of the two pilot projects were not too "serious". They could be eliminated or bypassed. Others could be resolved when iPad is redesigned, or when some other tablet offers better support for active reading.

Samples from interviews and surveys

Surveys were focused on both environmental questions (as mentioned in the introduction, mainly related to the reduction in printing) and on use for course work. Regarding the use of paper, we see a positive trend in both studies. The students have achieved a significant reduction in the amount of pages they printed for the Geology class. 57% of respondents have answered that they have printed much less than usual. Before the iPads, the school children used to make copies of the book pages in order to do exercises, but with iPads, they had no need to make extra copies. Thus, they too, have reduced printing significantly.

The first survey at the elementary school was held after the participants had been using iPads in class for one month. Just before the survey, the children had a read-aloud session. Each child had to read a particular story from the iPad for the rest of the group. After the reading, the children discussed the story. The survey was based on simple questions that were to be answered with a star rating (5 stars being the highest score and one star the lowest). Twenty children were at school that day, and 17 rated the iPad as a preferred or equal platform for reading. Only three were negative toward the reading experience on this new artefact. After four months, we asked if they had changed their minds over reading preferences. Twenty students were present: two had changed their mind in favour of books, while two had changed in favour of iPads. The balance remained the same: 17 for iPads, 3 for books. One of the participants who chose books did so on the basis of a usability issue with iPads: it was too easy to change the page and the student kept doing so accidentally. One of the students who chose the iPad on this occasion had voted against it previously.

Through the interview with the elementary school teacher we find that she considers iPads as both useful and enjoyable to have in the classroom, even though in some cases the results were poorer then when using traditional methods. An example here was an attempt to teach them about composition with the help of iPad App Puppet Palls designed for storytelling. While they were very engaged and entertained, the teacher evaluated the results as weaker in terms of learning outcome.

When asked if preparation for the class is more difficult now that she also needs to think about iPads, she said: "*No! It in fact simplifies matters. I can ask them to use their iPads to check things and they should manage to do it by themselves. They have tools for doing it by themselves (referring to Apps, Wikipedia or Google search). … They are also better at reading from the screen (referring*

to iPad). I skim-read, but they certainly get interested and immersed, and they actually got things from one text we were reading that I did not get, as I did not read carefully enough." (Trans. Culén).

When it comes to reading, 85% of children answered that they prefer to read from the iPad than from the book. They liked the ability to zoom in and out, and while reading, many of them were changing scopes often.

The data on the reading habits of the university students can be found in surveys. The two surveys are provided in their entirety at (Survey_Geology, 2010) for the first one and (Survey2_Geology, 2010) for the second one. Some highlights: 51.9% of students use iPad for reading less than an hour per day, 81% say that the benefit they got is that it is portable (easy to carry around).

While differences between the two groups of participants were numerous, there were some noteworthy similarities, too. Most notably, both groups enjoyed sharing the content from iPads and collaboration. All interviews with students were semi-structured and one of the questions we asked them all was in what situation have you found the iPad most useful. The answer was invariably related to work in smaller groups, when it was possible to share the information. The second most useful situation was while travelling, both in relation to the longer field work trips and localy. The schoolchildren already had the groups around iPad, the question for them was if there were any problem in sharing. Without exception, they said that sharing was not the problem but fun.

Conclusion

The pilot study conducted at the University level has pointed towards non-acceptance of iPads as a learning platform for Geology students. Various challenges contributed to this situation: from problems with physical space to academic challenge. The two variables that played an important role in the study were perceived ownership and perceived ease of use. A more thorough study is called for in order to better understand the ownership issues, especially in relation to the emerging cloud computing. In contrast, in the elementary school, we observed, but also heard from the families, the children and the teacher, that iPad enhanced teaching, learning and play. The variables that were most prominent for the acceptance of the technology were creativity, attitude toward learning and the emergence of new social patterns. The study with schoolchildren is now continuing, observing if there would be any changes in established patterns with prolonged use, as well as closer observation of how the device actually contributes (or not) to the learning itself now that the novelty of it is in the past.

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References

Barki, Henri; Benbasat, Izak. Quo vadis TAM? // *Journal of the Association for Information Systems*, 8 (2007), 4; 244–254

Buckingham David. Beyond Technology: Children's Learning in the Age of Digital Culture. Polity Press, 2007

Chen, Brian. Colleges Dream of Paperless, iPad-centric Education. April 5, 2010. http://www.wired.com/gadgetlab/2010/04/iPad-textbooks/ (August 30, 2011)

Culén, Alma Leora; Gasparini Andrea. E-book Reader and the Necessity of Divergence from the Legacy of Paper Book. // *Proceedings of the 4th International Conference on Advances in Computer Human Interaction*. Guadalope (France): (IARIA), 2011, 267 - 273

Culén, Alma Leora; Engen Bård Ketil; Gasparini, Andrea; Herstad, Jo. The Use of iPad in Academic Setting: Ownership Issues in Relation to Technology (Non)Adoption. // *Old meets new – media in education.* Aveiro (Portugal), 2011

Davis, Fred. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. // *MIS Quarterly*, 13 (1989) 3, 319-340

Druin, Alison. Mobile Technology for Children: Designing for Interaction and Learning. Morgan Kaufmann, 2009

Gasparini, Andrea; Culén, Alma Leora. Children´s Journey with iPads in the Classroom. // *Opportunities and Challenges when Designing and Developing with Kids @ School at the Interaction Design for Children Conference* (IDC 2011). Ann Arbor, Michigan, 2011

Green University. Grønt UiO. September 2010.http://www.uio.no/for-ansatte/arbeidsstotte/ prosjekter/gront-uio/prosjektleveranser/rapport-gronn-praksis-final-uten-vedlegg.pdf (July 29, 2011)

Hu, Winnie. More Schools Embrace the iPad as a Learning Tool. January 4, 2011. http://www. nytimes.com/2011/01/05/education/05tablets.html?_r=1 (July 29, 2011)

Hussein, Iltifat; Stanford School of Medicine is giving the iPad to all incoming medical students. July 30, 2010. http://www.imedicalapps.com/2010/07/stanford-school-of-medicine-ipad-incoming-class/ (August 31, 2011)

Sharp, Helene; Rogers, Yvonne; Preece, Jenny. Interaction Design: Beyond Human-Computer Interaction. Wiley, 2007

Staley, David. Adopting Digital Technologies in the Classroom: 10 Assessment Questions, EDUCAUSE 27 (2004), 3

Survey_Geology. iPad Survey Fall 2010. October 2010. http://dl.dropbox.com/u/11591411/ IpadSurvey.pdf (July 29, 2011)

Survey2_Geology. iPad Survey Fall 2010. December, 2010. http://dl.dropbox.com/u/ 11591411/Survey-2-Summary.pdf (August 31, 2011)

Vollen, Dag-Rune. Dansk skole tester Ipad-tvang. 23. August 2011. http:www.idg.no/computerwo rld/article217155.ece?nl=1 (August 31, 2011)

Wilson, Ian. iPads in Education. http://www.iPadineducation. co.uk/iPad_in_Education/Welcome. html (August 31, 2011)

White, Tracie. Will iPad transform Stanford's med school? September 2010. http://med.stanford. edu/ism/2010/september/iPads-0913.html (August 30, 2011)

YouTube. iAnnotate tutorial. Fall 2010. http://www.youtube.com/watch?v=As1Ds 9z8lNI (August 31, 2011)