Analysis of Tablet PC Based Learning Experiences in Engineering Classes

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Abstract: In this poster we present preliminary findings from a large scale initiative to implement Tablet PCs and related software in engineering courses at Virginia Tech. We present assessment data on the effectiveness of Tablets collected using end of semester course exit survey (N=525). The overall satisfaction with the implementation was positive as reflected in survey responses but students also raised several concerns with the Tablet interface and the software used.

Introduction

Tablets have a long history in the computing field and the last 5 years have seen a surge in the availability of Tablet PCs and their use in educational settings (WIPTE, 2007, Lohani et al., 2007, 2008). Tablet PCs are unique since they combine high computing power with direct pen-based input and unlike smaller devices, such as PDAs, they provide larger screen space as well. The ability to write on the surface of the Tablet using freeform digital ink is one of the primary features of these devices. This combination allows users to engage in several design activities such as sketching and ideation directly in digital medium, allowing them to easily store, manipulate, and share their creations. This is especially useful for engineering where representational forms such as diagrams, graphs, and equations are common.

Setting and Study

A Tablet PC computing initiative was announced by Virginia Tech in Summer 2006. Use of Tablet PC-based instruction was implemented in a freshman engineering course with about 1300 students in Fall 2006. Engineering freshmen at the College of Engineering at Virginia Tech are required to pass two freshman engineering courses during their 1-year long freshman engineering (also called General Engineering (GE)) program. The first course is called EngE 1024, "Engineering Exploration." A part of the Tablet PC implementation, students were engaged in several instructional activities including electronic note taking, use of inking features to review homework solutions, collaborative problem solving, completing skeleton PowerPoint slides, etc. These activities were designed to increase the engagement level of students in a large classroom and to facilitate collaborative sessions for undertaking group design project and problem solving. A number of lessons were learned in the first year of Tablet implementation (Lohani et al. 2007) and overall implementation was quite successful. Therefore, it was decided to increase the implementation and use of Tablet PCs and to assess their affect on learning among students. After the first year of implementation several changes were introduced in the curricula in Fall 2007, including introducing more Tablet-based software, different class exercises, and overall increased use of Tablets in the classroom and in workshops.

Findings

In Fall 2007, ~1300 engineering freshmen were enrolled in "Engineering Exploration" course. There were 8 large lecture sections and 45 workshop sections. Altogether, 5 faculty, 16 graduate students, and 8 undergraduate students were involved in EngE1024 instruction in fall 2007. The authors of this paper co-taught two classes with a total of around 450 students. The findings presented in this poster are based on an online exit survey conducted at the end of the fall 2007 semester. The survey was open to all students in EngE1024 and participation was voluntary. We received 525 responses for a success rate of ~40%. When asked in an exit survey (N=525) if the use of technologies in the class "effectively contributed" to their learning, 148 (28%) students responded "Strongly agree" and 242 (45%) students said "Agree." 69 (13%) students were "Neutral", 58 (11%) "Disagree," and 19 (4%) marked "Strongly disagree." Therefore, the overall response to the use of technology was positive. In particular, the use of the software DyKnow with Tablet PCs received strong ratings from the students with over 60% "Agree" or "Strongly Agree" responses to the item asking students to rate the helpfulness of DyKnow to their learning experiences. Almost 50% of the students indicated that they were using Tablet PCs in other courses as well (even though it was not required) and in particular they were using it for chemistry courses. It may be noted that in fall 2006 survey, only 36% students reported using Tablets in other courses (Lohani, et al., 2007). When asked for suggestions to improve their Tablet PC devices most students said that it needed better battery life and more processing power. Bigger screen size and better stylus response was also mentioned as desired qualities. Here are coded responses to other open-ended questions about the use of Tablet PCs.

Question: As you know, this is the first (second for 2007) year that engineering freshmen were required to own a Tablet PC. What in-lecture or in-workshop activities did you think the Tablet PC was useful for?

	# of Responses	Comments
Note taking	181	Most of the students used their Tablet PCs to take notes in one way or another whether through inking PowerPoint slides, importing the slides to OneNote, or typing information into the PowerPoint files
Sharing/ group work in shared session	45	The Tablet PCs were used for shared sessions in the workshop during the problem solving sessions. Most of the students also used shared sessions when meeting with their design project teams outside of the class.
Problem Solving	18	See above

Question: The most <u>interesting</u> aspect of the use of the Tablet PC in this course was:

	# of Reponses	Comments
Having a stylus to write/draw on the screen	224	Many students thought the best feature of the Tablet PC was the ability to write or draw digitally like they could with a normal pen
Shared sessions	43	Students liked entering into shared sessions to collaborate with their peers
DyKnow	59	Many students liked the various features of DyKnow such as the ability to polls students, collect student drawings or solutions to problems, and the ability to have a record of exactly what the professor was writing on the screen. They also thought the use of DyKnow in the lecture from Portugal was particularly interesting.
Organization	25	Several students liked the way OneNote allowed them to organize their notes so they could keep track of information not only for their EngE 1024 class, but other classes as well.

One of the most innovate experiments we did in our class was to use the Tablet/DyKnow (an interactive software; www.dyknow.com) combination alongside Skype and teach a class from a different geographic location. The first author was visiting Portugal for a conference during the semester and he taught the class from there with the support of the second author who was physically present in the class at Virginia Tech. The students watched the instructor (i.e., first author) on the large screen and were able to hear him. In addition, the instructor could hear the students in the class through microphone/webcam combination. The instructor controlled DyKnow from Portugal and was able to go through the lecture. In a survey conducted later, majority of the students found this lecture to be "as good" or "better" than the co-present one. Few students expressed the need for the physical presence but all of them expressed that they found this innovate and were more engaged given the novelty. Although this was just a trial, it provides support that a "virtual" class can be supported using DyKnow. Some students took advantage of the possibility of joining class from a remote location particularly when they were not able to come to class due to various circumstances.

The findings suggest that students continue to appreciate the potential of Tablet technology especially if they keep using it for enhancing learning experiences in various courses. It is clear from data collected in freshman year exit surveys in fall 2006 and 2007 that a significantly higher proportion of students find Tablet PCs useful in courses which do not explicitly require the use of the Tablet PC. Based on students' feedback, it seems that the Tablet PC hardware is improving in reliability and OneNote has improved from the 2003 version to the 2007 version. There is still a significant room for improvement in both hardware and software for the Tablet PCs. Tablets combined with software like DyKnow definitely have the potential to improve teaching pedagogy in engineering. We do not intend to suggest that we did not receive negative responses to the use of Tablet PCs but with increased reliability and in better combination with courses, the overall response was positive.

References

Lohani, V. K., Castles, R., Lo, J., and Griffin. H. (2007). *Tablet PC Application in a Large Engineering Program,* Proceedings of the 2006 American Society for Engineering Education Annual Conference and Exposition, Chicago, IL, June 18-21, 2006.

WIPTE (2007). Workshop on the Impact of Pen-Based Technology on Education. Purdue University.

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