

Tablet Teaching Pilot Program

A Request for a Half-Time PhD Research Assistantship (2009/10)

Submitted to the I³ Graduate Funding Opportunities Program

University of Colorado at Boulder

May 26, 2009

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Abstract

Our project will build a pilot program for the testing and use of tablet technology in the computer science classroom at CU. We will explore the effectiveness of tablet PCs and laptops as a teaching tool as well as the how the tablet PC can enhance an existing pedagogy.

In the first year we will build the tablet classroom system which includes a dedicated server; we will design curricula based on the new technology for two courses, CSCI2824 (Fall 2009) and CSCI1300 (Spring 2010). The curriculum will be implemented with voluntary student participation. In future semesters, we will expand the program into other classes and departments as we research the technology's effectiveness as compared to other existing technologies and how pedagogies are adapted to the technology.

The hardware for the project is already funded by a \$4000 grant from the Engineering Excellence Fund, supplemented by post-tenure funds from Michael Main (\$500) and personal funds from Ph.D. student David Cheeseman (\$455). This proposal to I³ is to provide a half-time research assistantship for David for the 2009/10 academic year, during which time he will implement the pilot program and complete his thesis proposal in this area. The other half of David's support will come from a teaching assistantship.

Tablet Teaching Pilot Program

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I. Introduction

Collaboration and active learning is a necessity often neglected or ignored in today's classroom. In recent years, the use of tablet PCs and laptops in the classroom has risen and has shown great promise in providing dynamic and effective classroom collaboration. While existing technologies such as clickers and even cell phones have shown great utility in the classroom, new teaching software for tablet PCs and laptops has added a new paradigm of in-class collaboration through technology.

II. Program Implementation

Our pilot program is designed on a 1-year timeline and will begin in the fall of 2009. As a pilot, it will bootstrap a future NSF proposal in 2010 and provide the basis for David Cheeseman's thesis proposal. During the fall semester we will build a DyKnow Vision server for use in hosting collaborative classroom sessions. We will then proceed to test the server and design a curriculum around the collaborative technology.

During Fall 2009 we will offer the use of the tablet technology on a voluntary basis in CSCI2824 lecture and recitation (about 50 students). Students who participate would have a usb-wacom tablet to use throughout the semester. The same idea will be carried into CSCI 1300 (about 200 students) in Spring 2010.

After the pilot program's term, the system would continue to be held under the ownership of the College of Engineering and would be used for further research into collaborative technology in the classroom.

III. Current Work

Tablet technology was used in the spring 2009 section of CSCI1300 to provide in-class lecture notes online in PDF format. This allowed students to focus more on the lecture content rather than busying themselves with copying notes. Also, a small purchase of 5 licenses of the DyKnow Vision software by David Cheeseman was already made and tested in an in-lecture collaborative activity.

IV. Immediate Research Prospects

Voluntary Participation in Collaborative Classrooms

When we offer the use of tablet based collaborative technology, we will have the opportunity to examine how students respond to the availability of the technology in a voluntary participation setting. For each topic of the class, we will be able to compare the performance of three groups: the non-volunteers, a portion of the volunteers in a control group (not using the technology) and a test group (using the technology). This gives us the opportunity to examine how students respond to the availability of the technology and measure the voluntary participation throughout the course.

V. Post-Pilot Research

Cost/Student-Benefit Technological Assessment

While many studies have assessed tablet PC technology in the classroom, only a few have compared them to other existing technologies and only one has analyzed the cost-benefit of implementing a tablet program^[7]. Also, while tablet PCs are often compared to standard lecture or PowerPoint presentations, they have not been critically compared to clickers or video-enhanced classrooms. CU offers a unique proving ground for tablet PCs as there are several existing technologies already implemented on-campus. In future semesters, we will analyze the cost/student-benefit of these technologies and tablet PC technology against each other using our pilot program.

Transition of Pedagogy to Tablet Technology

Prior studies have investigated individual classes or classes within a department, but not particular trends in pedagogical adaption to collaborative technology in a campus-wide setting. As we continue to use and expand our tablet teaching program, we will investigate how instructors adapt their existing pedagogies to collaborative teaching software. The functionality of the tablet teaching software gives instructors a set of tools which are not commonly available in most classrooms; how teachers adopt and use those tools is something we would like to observe. Along with our interest in comparing teaching technologies, we are also interested in assessing tablet teaching software's utility in a more universal sense across many departments and not just one particular class or the Computer Science department alone.

VI. Educational Benefits

The use and testing of tablet teaching software has been shown through many studies and surveys to be an effective tool in the classroom for both students and instructors^[1,3,6]. Software such as the University of Washington's Classroom Presenter^[10] and the Dynamic Knowledge LCC's DyKnow Vision^[9] has been cited in many journals and conferences as being able to facilitate classroom collaboration and effective in-class learning. Fifty to 200 students will be immediately affected by our pilot program. Due to the scalability and licensing of our software selection, as we pursue our post-pilot research goals, we will be able to easily accommodate more classes or other departments in our program. While the scope of the pilot program is small, the number of students who will be affected by this program can easily grow beyond the students taking our classes.

VII. Technical Implementation

For this project, the DyKnow Vision^[9] software was chosen because of a host of features which enhance both in-class learning and out of class review which are not available in other open-source software solutions.

The basic and most common feature used in DyKnow is its electronic ink panels. In class, the notes from the teacher's workstation or tablet (prepared or written on-the-fly) are sent to the students' computers via a network connection, allowing students to listen to the lecture as the notes are written as opposed to copying the notes by hand. If the students have a computer, whether it is a regular laptop, tablet PC, or computer with a usb-wacom tablet, they can annotate the professor's notes with using a number of text and mouse-driven drawing tool.

To get feedback from the students during lecture, DyKnow has also implemented polling and related functionality. During class a professor can write up a question on a slide and submit a poll to the class. The results can then be retrieved (anonymously or with the name of the submitter), saved, or even included in the lecture notes using several visualization options. DyKnow also has implemented a status-update functionality: at any time or at the prompt of the instructor, a student can update their status between three options from a drop down box that describe their level of understanding. When a status is updated, the results are immediately registered on the instructor's workstation in a visual graph and in the session roster, providing instant and impromptu feedback from the students and thus allowing the instructor to change the course of the lecture accordingly.

To engage the students during class, an instructor may write-up an exercise and give it to the students to complete, after which the students can submit their answers via panel submission (anonymously or otherwise) or the professor can collect the designated panel from all the students. Students can work alone or in small groups organized by the instructor through a shared-surface feature which allows multiple students to work on the same drawing surface without interfering with other groups. The submissions can then be quickly browsed and relevant answers posted to the classroom session. The professor can also give control to the live session to one or any number of students to do in-class live exercises or to allow a student to provide their own perspective to the class session.

To help facilitate effective review of notes, the DyKnow Vision client also has a replay function implemented. This function replays the notes as they were written in class, allowing students to view the process by which notes were generated and not just the final result. The review functionality also allows for the recording of lecture audio into the notes themselves (currently in beta-release development), which can later be retrieved from the server and played alongside the replayed notes in a synchronous manner. All notes can also be saved to the DyKnow server and be retrieved from any computer via the DyKnow software, allowing students unlimited access to their notes.

DyKnow also provides a tool which makes transitioning from other technologies to the DyKnow software easier. The DyKnow Notebook Writer is a software printer which can take any printable document, including existing PowerPoint slides, and save them as a DyKnow notebook panels. These panels can then be integrated into prepared notes or included during the lecture on-the-fly.

Aside from these features, there are a number of other reasons to choose the DyKnow software over its alternatives. DyKnow, as an enterprise software solution, provides support and training for instructors and system managers. DyKnow licenses are also flexible in the sense that if you buy 150 student

licenses, you can serve multiple 150 student classes, as long as they are not conducted at the same time of day. This aspect of the software will make integrating other classes or departments more flexible as we will not necessarily need to buy more licenses to handle more students. Finally, and possibly most importantly, the license is persistent, meaning once a license is purchased it is owned indefinitely. Also, every license comes with free software support and upgrades for one year, after which only a small subscription fee to the support and upgrade service is needed. For our pilot program we plan on buying 40 student licenses and 2 instructor licenses. This will not only get our pilot program in place but will also boot-strap our NSF proposal for 2010.

While other options are available, they offer only a limited number of features as compared to the DyKnow Vision software. Considering the features, the license terms, support, and training available, we have chosen the DyKnow Vision software for our pilot program.

Though DyKnow Vision is a feature-rich software solution, its hardware requirements are surprisingly lean. To facilitate a 150 student class, the software requires only a server with a single-core processor and 1 gigabyte of ram; classes up to 500 students can be serviced by a dual-core machine with 4 gigs of ram. Storage space is also lean: a typical semester's-worth of notes for a class requires roughly 1GB of space for 25 students if notes are saved to the server. To be able to facilitate large classes in our post-pilot research, we will use mostly existing existing equipment to build a robust, dual-core server system with at least 500GB's of Raid Level 1 hard drive space. This system will then be registered with the school's DNS so students can connect to the server to review notes on and off campus.

VIII. Project Team Qualifications

Associate Professor Michael Main has extensive experience in teaching CSCI1300 which will directly aid in the transition of the class to a collaborative atmosphere. Prior to his graduate study, he received teacher certification in science and math. He will be teaching CSCI1300 in spring 2010 and supervising the project. He has supervised nearly a hundred teaching assistants, coauthored a widely-used textbook with Walter Savitch, and won multiple teaching and advising awards from the College of Engineering and the Boulder Faculty Assembly.

Team member David Cheeseman is a first year graduate student and has an extensive history of use and development of tablet teaching technology. David spent his undergraduate career at DePauw University which is the founding college of the DyKnow tablet teaching software. Throughout his career at DePauw, every class he took in Computer Science was conducted in a DyKnow enabled classroom. David has also spent time developing with DyKnow through summer internships and semester work on low-level projects such as the DyKnow Notebook Writer and Microsoft Ink coding development. As a result, David is well versed in the use of tablet technology in classroom through his student experience and has a thorough knowledge of the software selected.

IX. Matching Funds and Other Support

David Cheeseman has provided \$455 of personal money for presentation/training/hosting software. Michael Main has provided \$500 from post-tenure research funds. The Engineering Excellence Fund has provided \$4000 for hardware, and the Department of Computer Science will provide a half-time teaching assistantship for David.

The work will be the basis for David's thesis proposal, to be presented to his committee in 2010.

Project Budget

REQUEST TO I³ for Half-Time Research Assistantship 2009/10 Academic Year	\$14,338
Matching Assistantship Funds (already committed) Department of Computer Science Half-Time TA	14,338
Funds for Hardware (already committed) Engineering Excellence Fund	4,000
Post-Tenure Funds from Michael Main	500
Personal Funds from David Cheeseman	455
Total for 2009/2010 Year	\$33,631

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