

# Work in Progress - Assessing the Impact of Pen-based Computing and Collaboration-facilitating Software in the Classroom

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**Abstract** – Our project focuses on evaluating the impact of pen-based computing devices and collaboration-facilitating software in the engineering, science, and technical communication classrooms. The faculty members engaged in the project are implementing pen-based devices (both HP tablet PCs and Wacom pen slates) in their courses. In order to take full advantage of the technology, these instructors are also using DyKnow Vision software to encourage students to work together, to reduce students' time spent copying notes and problems on the whiteboard, and to encourage more efficient methods of studying for exams. The assessment component of the project includes both formative and summative methods deployed throughout the 2006-07 academic year.

*Index Terms* – Assessment, DyKnow Vision Software, pen-based computing.

## INTRODUCTION

Pen-based technologies like tablet PCs and pen slates afford engineering educators a fresh opportunity to increase the visual dimension of many different types of courses. At Rose-Hulman we have developed curricula that use pen-based technologies in five courses drawn from different disciplines: Design for Manufacturing (mechanical engineering); Engineering Chemistry; Introductory Physics; Software Requirements and Specifications; and Technical Communication. A total of 259 students enrolled in these courses and participated in the assessments during the first year of this two-year project.

While pen-based technologies allow us to enhance the visual dimension of a course, these technologies are their most powerful when they simultaneously facilitate collaboration — between faculty and students, between students, and between one class and another. Our project work focuses on the

assessment and evaluation of the impact of a symbiosis of hardware and software (DyKnow Vision [1]) on teaching and learning. Students in the study used either a tablet PC or a pen slate with the DyKnow software.

## ASSESSMENT COMPONENT

Assessment has been developed at two levels for this project. One level of assessment is the development of classroom assessment techniques, or CATs. Basing our project on the work of Angelo and Cross [2], we have identified CATs appropriate to each course and then adapted them into the pen-based computing/DyKnow environment. We have also made use of CATs that are already features within DyKnow, like the participant status and polling features. Each instructor can use CATs to gauge student learning in real time and make pedagogical adjustments as needed.

In the Engineering Chemistry course, for example, the instructor developed a misconception/preconception CAT in the context of the DyKnow polling feature. Students are asked to record their response to the poll; the results of the poll are used by the instructor to gauge the false assumptions and beliefs, the “preconceptions” of the students at the beginning of the topic discussion in the class. The instructor can then display the poll results to the class and reveal the correct answer (the answer had been hidden on the original panel but is then revealed along with the poll results). Based on the results of the CAT, the instructor can modify his/her pedagogy

The second level of assessment includes both formative and summative assessment components measured through a mixed methods design. Formative assessment focuses on improvements instructors can make when using DyKnow and pen-based computing devices in class. Formative assessment data is collected through instructor-chosen CATs; instructors prepare weekly logs to document their use of CATs in the classroom, then share those logs with other faculty in the

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project group. In addition, summative assessment is used to measure success in implementing pen-based technology in classes in various disciplines and is collected quantitatively and qualitatively. Summative assessment was also used to measure students' knowledge of and confidence in a set of defined learning outcomes for the course. Quantitative data is collected through self-report surveys, while qualitative data is collected through focus groups and open-ended items on self-report surveys.

The quantitative dimension of the project is comprised by two surveys: pre-course and post-course. The pre-course survey serves as a baseline for each course while the post-course survey assesses technology usage and learning following students' usage of pen-based devices and DyKnow. The pre-course survey contains 6 items:

- Previous use of computer devices (a desktop, laptop, and pen-based computing device (either tablet PC or slate))
- Frequency of use for each of these devices
- Perceived usefulness of each device to complete specified tasks, such as "taking notes" and "preparing for tests"
- Interest in using a pen-based computing device
- Knowledge of and confidence in a series of course-specific learning objectives
- And tools used to take notes.

During the first iteration of the project, the pre- and post-course surveys were administered during the first and last weeks of the fall quarter in 2006 (August 2006—November 2006) in 3 courses: Introductory Physics (PH 113), Software Requirements and Specifications (CSSE 371), and Technical Communication (RH 330). A total of 131 students participated in the survey. During the winter quarter (December 2006—February 2007), the survey were administered for Engineering Chemistry (CHEM 201), Design for Manufacturing (ME 317), and Technical Communication (128 students participating).

The post-survey consists of 12 items; some items contained a single question, while others contained multiple questions. Three of the items are identical to the pre-course survey addressing frequency of use of each device, perceived usefulness of each device, and ratings of knowledge of and confidence in learning objectives. Additional items in the post-course survey are as follows:

- Desire to use the current model tablet PC or the latest model tablet PC for future courses (two questions)
- Preference for a pen-based computing device over a laptop
- Desire to utilize a pen-based computing device in and out of the classroom (two questions)

Students are also asked what hardware device they used with DyKnow (two questions), satisfaction with their learning experience, and preferred note taking tool (two questions). Post-course surveys for CSSE 371 and RH 330 contained 3 additional items regarding peer review tools and experience.

In addition to the pre- and post-course surveys, a focus group has been implemented. The focus group consists of 9 items focusing on student experiences with the pen-based

device and DyKnow combination. A random sample of students from each course involved with the assessment were invited to participate in the focus groups.

### METHODOLOGY

Since this is an two-year project, the surveys were conducted again during the 2006-07 academic year at the end of the winter quarter for students enrolled in Engineering Chemistry, Design for Manufacturing (mechanical engineering), and Technical Communication. Beginning in summer 2007, a new set of courses will be targeted for the project, although the survey instrument will remain consistent when it is implemented during the 2007-08 academic year. We are currently engaged in the process of analyzing the data from both the fall and winter quarters.

### PRELIMINARY RESULTS AND CONCLUSIONS

Because we are still in the process of compiling the data and analyzing the results, our conclusions are quite preliminary. Based on both our analysis of the quantitative and the qualitative results, however, we can see some initial trends in the information.

With regard to classroom interaction: one benefit to using DyKnow with the pen-based devices in class was the ease of allowing the professor to see who was paying attention in class through panel submissions. An additional benefit mentioned by students included a quicker pace to the lecture since the notes were already available and multiple-choice quiz questions could easily be posted and answered. Students did, however, report paying less attention in class compared to traditional courses not using pen-based devices and DyKnow since the technology made it easy to multi-task and still catch back up with the provided notes.

With regard to class notes: students during the focus group almost unanimously reported a decrease in their note taking with DyKnow throughout the quarter. Some students felt they did not need to take notes for their course while other students preferred the greater flexibility of taking notes with pen and paper. Students did not care for the multitude of pages DyKnow created when taking notes, did not like the constraint DyKnow placed on their note-taking style and organization, and felt they needed to take notes themselves so that they would pay attention in class and not become so easily distracted.

### ACKNOWLEDGMENT

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### REFERENCES

[1] DyKnow Vision, Inc. <http://www.dyknowvision.com/>

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