

SENECA COLLEGE OF APPLIED ARTS AND TECHNOLOGY

HP tablet PCs transform teaching and learning in mathematics class



Seneca

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HP CUSTOMER CASE STUDY:

Learning with HP tablet PCs ignites interest in mathematics

INDUSTRY:

Higher education

OBJECTIVE:

Improve the engagement and retention of marginalized math and science students

APPROACH:

Seneca College of Applied Arts and Technology in Ontario launched a pilot program with HP tablet PCs using DyKnow Vision® software

EDUCATIONAL BENEFITS:

- Improved attendance
- More collaborative in-class problem solving
- "Write-on" technology facilitates computer use in math
- Anonymous instant polling helps to assure students aren't left behind if they don't fully understand a concept or lesson
- Ability to integrate handwritten notes, typed text and material imported from the Internet in a single document



Over the past several years, Carol Carruthers, professor and coordinator at Seneca College of Applied Arts and Technology, has experimented with various technologies in her college math classroom to motivate and engage her students. However, each one seemed to have its drawbacks and none of them made a dramatic difference in her teaching or in students' learning.

Then she tried teaching with HP tablet PCs in combination with DyKnow Vision® software. Students liked having the hands-on technology. But more importantly, they dove headfirst into the subject matter. Students who didn't like math, or had purposely avoided math classes, were suddenly, and successfully, solving problems in a shared on-screen workspace that everyone could see.

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"I've been a math teacher for almost 30 years, and through all that time, I have never seen anything have this effect on students," says Carruthers. "With HP tablets, my classroom is more collaborative today. The air is charged with enthusiasm which is evident in the level of activity and noise. That's not your traditional math classroom, especially one with students who have said they hate math."

OVERCOMING THE ODDS

To put this in perspective, the College Mathematics Project, a five-year study led by Seneca College of Applied Arts and Technology in Ontario and expanded to include all 24 colleges in the province, found that 25% to 50% of first semester students either fail or barely pass mathematics, which puts them at risk of not completing their chosen program. This poses quite the challenge for educators. The College Mathematics Project provides achievement data to the colleges and school boards, which in turn respond with strategies to increase student success.

To mitigate this trend, as part of a faculty-wide strategy, the college created the Applied Science and Technology Fundamentals (AST) certificate program. It was designed to assist students with educational deficits through a two semester program of transitional courses that strengthen their skills and confidence in mathematics, communication, critical thinking and problem solving. Carruthers teaches in the AST program.

"These are students who, for whatever reason, have not been successful or have not taken the coursework to prepare them for college, especially college mathematics," she explains. "They are less likely than other college students to be engaged in the classroom."

Carruthers had tried other classroom technology to engage her students with limited success. When the dean of the faculty of Applied Sciences and Engineering Technology offered her a chance to use an HP tablet PC and digital projector, she found it worked beautifully in class.

"I was able to face the students and remain connected with them. The students could all see the work, and by recording the solutions, we could go back and review the process and even post the solutions for students who were ill or missed class," she explains.

The next step was putting HP tablet PCs in the hands of students. Each student in Carruthers' pilot program has an HP Compaq 2710p Notebook PC with tablet capability—PROVIDED BY AN HP TECHNOLOGY FOR TEACHING GRANT—running Genuine Windows® Vista Business and preloaded with DyKnow Vision® software. Carruthers creates a "notes" document that is distributed by a DyKnow session to each student, where the class works through problems together. She leaves the left side of the document empty; that's where each student develops his or her own solution. The right side is for shared work. Students can see their own work with class work right beside it, giving them the opportunity to self correct as needed. Errors in understanding are noted immediately, and notes taken for review and study are accurate.

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"Everyone can write in an answer or contribute to the solution," she says. "The beauty of it is that they can solve problems anonymously, so everyone can see correct solutions, but nobody has to know if a fellow student is struggling."

"WRITE-ON" TECHNOLOGY

The distinguishing feature of the tablet PCs is what Carruthers calls "write-on" technology—using a stylus like a pen or pencil to write on the screen, which she says is critical to using a computer to teach math. "You just can't type everything required to create a math equation and solve the problem," she says. "Students need to be able to work freely in an intuitive way, and in the computer environment, a tablet enables them to do so."

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One of the features of DyKnow—instant polling—gives Carruthers immediate, anonymous feedback on how well students understand the material. When students understand a solution or a new concept, they literally send her a green light. If they're unsure, they might send a yellow light. In that case, Carruthers can review the solution again or try another approach to explain the concept.

The notes document becomes a repository for ideas that come from class—which Carruthers and other students add to as the lesson progresses. "It's a fluid process—the professor teaches students, students share with one another and it becomes very collaborative," Carruthers

says. "It has allowed me to step back as a teacher and guide the class. Students are leading the conversation much of the time. I'm no longer up front with my back to the classroom. Instead, I'm roaming, seeing who's grasping the subject matter and who's not, and everyone is contributing."

The HP tablet PCs don't go home with students, but students can download a DyKnow client to their own PCs or some other computer to access their notes. Collaborative notes are stored on a server which students can access 24/7 from the library, computer labs, or a personal computer anywhere there is an Internet connection.

Separate from the group process in class, students can submit solutions to problems directly to Carruthers online,¹ which she can review after class and return with her comments and suggestions at any time. The exchange of information is continuous and anonymous—some math learners don't want the rest of the class to know they need more help to understand a concept. In addition, the tablet PCs become a gateway to other learning tools which include an online textbook and a variety of web-based resources.

"The ability to go anywhere and take notes in handwritten form, or type, to draw pictures and integrate all that content, really distinguishes the tablet PCs," she explains.

She particularly likes the ability to illustrate abstract concepts with resources on the web. It's one thing to teach about a sine wave, she notes, but when you can use an applet that relates sine waves to tides on the Earth or human respiration, then students can visualize the concept.

"The question from students is always, 'Why do I need to learn this?' If you can illustrate mathematical concepts and relate them to the students' lives, then they'll understand it much better."

EVALUATING PROGRESS

Carruthers is now quantitatively evaluating the results of her initial foray into using tablet PCs in the classroom. Attendance and grades have both improved. "Our pilot data demonstrates a clear correlation between the use of HP tablet PCs with DyKnow software, and the engagement and retention of marginalized math and science students," she notes.

CUSTOMER SOLUTION AT A GLANCE

PRIMARY APPLICATIONS

Developmental math courses

PRIMARY SOFTWARE

- Genuine Windows Vista®
- DyKnow Vision®

PRIMARY HARDWARE

- HP Compaq 2710p Notebook PCs

The anecdotal evidence is equally clear. "Comments from students have been very positive; they're involved and excited in ways I haven't seen before," she says. One student told Carruthers she had regained her confidence and would like to teach math. Another told her that putting math onto an easy-to-use computer captured his attention and kept him coming to class.

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"It's wonderful to see students overcome their math anxiety and finally triumph over something that has negatively influenced their belief in themselves for far too long," Carruthers says.

Carruthers, along with the science teacher in the AST program, who is also using the HP tablet PCs in class, were nominated by their students in the "Ontario's Best Lecturer" competition.

In addition, Carruthers and her students have created two YouTube videos and entered two competitions to demonstrate to others how they use this technology in the classroom.

Until now, the school has had only enough tablet PCs for one 20-seat classroom. Looking ahead, it has invested in an additional 100 HP tablet PCs. In the fall of 2010, the school will open the original classroom to larger classes, and create an additional 40-seat tablet PC lab. The school will be offering math, science and English classes using the tablet PCs.

"My assumption is that tablet PC technology, or something like it, will become common at Seneca College within the next five years," says Carruthers. "It's a real difference maker."

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¹ Wireless access point and Internet service required. Availability of public wireless access points are limited.

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