Can Numeracy and Technology Work Together?

by **Kelly Edmonds**

A couple of years ago, I began teaching mathematics to adults returning to basic education. I was eager to find ways to reach and teach the adults in my classes, most of whom were working at a level equivalent to grade eight and nine. When I started I was delivering a standardized curriculum, but over two years my teaching evolved into a blended approach that included technology.

The adult learners in my classes came from varying backgrounds and cultures, and they had tenuous educational levels. Most terms, half the students were white, a quarter were aboriginal and another quarter were newcomers struggling with English. Many of the students had dropped out of school, were single parents, and had experienced unsuccessful learning.

As a teacher and technologist, I was looking for ways to integrate technology into the program. I wanted to cater to a range of learning styles, to reinforce new concepts, to increase opportunities to practice math tasks, to create a way for learners to continue their learning outside the classroom, and to modernize the curriculum. I used a web site that other teachers in the program had developed, and I upgraded it to include more instruction and practice around hard-to-learn concepts. The web site offered explanations of mathematical concepts, rules of application, and online interactive activities and games so that students could practice concepts and skills. Each page addressed one unit of the curriculum. The web site was in a password-protected learning platform called WebCT, which I also used to e-mail students, post marks and final grades, flag important dates on a calendar, and present the learning content.
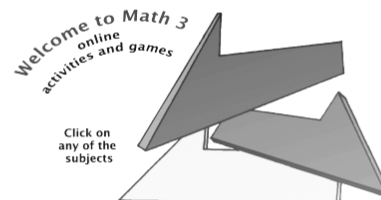
Why use online resources?

Technology has become commonplace in North America, and prevalent in mainstream public education (Kubey). More importantly, more and more schools are using technology with students who struggle with learning disabilities (Lewis). Many struggling learners face obstacles such as language barriers, physical barriers or life struggles. These learners have reduced chances of successfully completing high school (Splittgerber and Allen; Price, Field and Patton).

Example of Computer-Assisted Instruction

Online Math Games

- Parallels curriculum, pace and terminology
- Appropriate for content and process, not age
- Navigation supported
- Learners can choose games and levels
- Scaffold learning: steps, prior, visuals, practice, immediate feedback, and challenges

Welcome to Math 3 online activities and games

Click on any of the subjects

http://www.members.shaw.ca/webdesign15/math3/index.htm

Adult learners, who may have struggled with learning all their lives, can benefit from the support offered with computer-assisted instruction (LDAC). However, very few studies have looked at how adult learners can benefit from technology (Nicol and Anderson). Opportunities for using computers seem limited to mainstream education (Brown).

One study reviewed how computers could help a researcher in her teaching practice with at-risk learners (Wallis). The students she worked with struggle with ADHD (Attention Deficit Hyperactivity Disorder). However, she offers a useful perspective on effectively using computers with all struggling students. Citing Lewis, she applauds computer-based

Example of Computer-Assisted Instruction

Online Math Course   www.cbelearn.ca

Dividing Fractions

Order of Operations
and Integers

individually with the math web site. To assess the results, I compared the achievement levels of the class which used the math web site to the levels of the class that did not. Achievement was measured using a number of similar print-based quizzes and tests. I also surveyed the technical skills and learning needs of the experimental group and, at the end of 16 weeks, asked for their feedback on using the computer lab. Finally, I documented my observations on the students' interactions and learning behaviour, both in the classroom and in the computer lab.

The math web site I developed included many of the technical features and activities mentioned by Wallis. Not only did it have an organized layout, it offered links to interactive math activities, challenging math games, online quizzes, concepts illustrated through visuals and text, and other features such as graphical categories, a customized calendar, and e-mail.

learning for its ability to provide immediate feedback, self-paced learning, and individualized instruction. In her study, Wallis found that students who used computers had increased self-esteem and were more enthusiastic about school. The simulated nature of computers increases novelty, and keeps students on task with organizers such as calendars, program outlines, and graphics. Navigational aids and self-paced learning features give students independence in their learning. Finally, Wallis found that her students learned more effectively with computers because they were given many opportunities to arrive at the correct answer. Well-designed software can provide prompts after a number of attempts, or automatically move on to more challenging material.

My research

Many of the students in my Adult Basic Education classes had both learning disabilities and barriers which impeded their past and present interactions with learning. I wanted to investigate whether technology could help. I felt that learning organizations and post-secondary institutions could benefit from knowing more about teaching adult learners with special learning needs. I hoped my research would help promote this method of instruction.

To monitor the effects of using technology within this basic mathematics program, I set up a research study to compare one class that used the math web site with one that did not. The experimental group spent an hour a week in a computer lab, interacting

What I learned

My preliminary analysis revealed that the students who used the computer lab achieved significantly higher on their test scores compared to the control group. That is, the experimental group showed greater difference in their pre- and post-testing marks. My qualitative analysis indicated that the students who engaged with technology had increased confidence levels and were more satisfied with learning math. They successfully transferred knowledge between the computer lab and classroom and their understanding improved because of increased practice which the computer lab allowed. As well, I found the online learning complemented the classroom teaching, and satisfied different learning styles. I used the web site to highlight difficult-to-learn concepts: it provided scaffolded steps with visuals, examples and interactive practice. The online content became less threatening because it was self-paced material, learners saw immediate results from interactive activities, and their work was not graded. However, most students still needed my guidance as they learned to manage their work online.

How to teach using online supports

Here are some of the things I learned as I taught:

- Consider what at-risk students need. Scaffold the learning. Make sure you connect to their prior knowledge. This will enforce their understanding of concepts. Learners must have a base to work from or they will remain lost.
- Focus completely on students attaining factual knowledge before they apply the concept. Use ample learning aids to scaffold their online learning.
- Allow students constant practice of single concepts. To provide plenty of varied practice, link to interactive web sites that include learning activities or games.
- Provide continual, in-person support for online learning. Students can become lost within web sites, or confused about how to use the digital materials and activities.

- Build trust with the online tools. Create a non-threatening environment by offering unmarked exercises and tests, allowing self-paced learning, and using web pages that are easy to understand and navigate.
- Make sure that content includes very clear and visual explanations and examples along with immediate practice.
- Only apply incremental levels of difficulty, and make sure you frequently link back to previous concepts.

Learning in the computer lab gave students new technical literacies and additional venues to practice mathematics, to increase their understanding of concepts and applications, and to communicate with the instructor. Overall, using computers became a great reinforcing tool as well as an instructional backup for those who missed a lesson. When struggling learners work with online content, they have a chance to learn differently and at their own pace. They can learn more and feel better about what they have achieved. ■

Websites I recommend

The following sites all use great methods and terminology.

- Math.com: the world of math online
  www.math.com

- A+ Math
  www.aplusmath.com

- Mrs. Glosser's Math Goodies
  www.mathgoodies.com

- Interactive Newspaper (Wellington County Learning Centre, Ontario)
  www.thewclc.ca/edge

Software resources I recommend

"Using Software Applications to Teach Math" by Catherine Cantrell. Available online at **gseweb.harvard.edu/~ncsall/fob/2000/ cantrell.html.**

Canadian evaluations of software programs are available online at **www.nald.ca/software/ software_list.asp**

A Canadian index to web resources is available at **www.alphaplus.ca/opnhs/english/SiteList.asp? IndNm=108**

Kelly Edmonds is a teacher who has nearly completed her graduate studies in educational technology at the University of Calgary. For many years, Kelly has worked with struggling students, teaching them literacy, numeracy, technology and entrepreneurial skills. Her research has shown promising uses for technology in all levels of education, and she continues to explore this teaching and learning method.

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