Editorial… Use of multimedia in mathematics education

Michael E. Hale

In the rush to reform our public schools, many decision makers turn to technology. These decision makers appear to believe that schools will be transformed into better learning environments if schools buy enough computers. Multimedia is the current technological lighting bolt in the storm of reforming schools by implementing technology. Multimedia is the mystical quick fix that can transform schools from dull dungeons of teacher-directed recitation to shining towers of motivated self-assessed student learning. If you do not believe in the power of multimedia computing, ask any salesperson or researcher.

Multimedia is very enticing. It's new. It's technology and Americans love new technology. Multimedia merges text, graphics, audio, and video into one entity. In this world where children's standard entertainment fare ranges from *Looney Toons* to MTV's *Liquid TV*, how can the school curriculum compete? What are ways that multimedia computing can help in the learning of mathematics?

Context

One way of using multimedia is to communicate context. For example, teachers can use multimedia software to provide a historical context for a mathematics concept. The importance of a mathematics concept or skill is difficult to communicate in relation to other concepts or skills in a curriculum sequence because students lack a sense of mathematics as a whole. A teacher should provide an understandable justification of why a mathematics concept or skill is necessary and meaningful. The *Mechanical Universe*, a videodisc[1] series produced by the Annenburg Foundation, includes many historical vignettes, such as Sir Isaac Newton's explanation of circular motion. By presenting these vignettes, teachers can communicate the significance of mathematics to the development of civilization.

In addition to historical contexts, real world uses of mathematics can justify the importance of students' classroom work. Multimedia images of current applications of mathematics give students a dynamic impression of mathematics.

Another setting in which multimedia can be used to provide a context for mathematics is problem solving.

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Multimedia material provides a rich visual and auditory context for a problem as in the *Jasper* videodisc series developed by Bob Sherwood at Vanderbilt University's Learning Technology Center. Using a *Jasper* videodisc, the teacher plays a believable narrative and stops with a problem statement. For example, within one of the multimedia narratives students see and hear information about Jasper's trip down a river to buy a new boat. At the end of the narrative Jasper asks himself if and how he can get home with the new boat. Embedded in the narrative are all the data needed to solve the problem. The application of students' problem solving skills in a multimedia context is only a small step away from the transfer of the skills to everyday life.

Visual Display

Computers have evolved from text-only terminals to powerful tools for visualization. Multimedia computers today are capable of near photographic images and full motion video. Instead of four color diagrams made with the wretched brown, red, green, and black of an IBM PC-XT, students can see video of a real bridge, such as the collapsing Tacoma Narrows Bridge, with animated force diagrams overlaid.

Teachers have used computers to help with graphing for some time. Graphs are a powerful visual representation. The graphical environments of the new multimedia computers support the creation and manipulation of graphical data in many formats. Multimedia can enhance students' work with graphs by allowing them to select audio for help or interpretation of important graphical components. Animation is available to help students see and manipulate mathematics. The creation of real time animated functions is possible with the increased computing power of today's microprocessors.

Learner Attitude

Television producers and advertisers understand the power of video to influence attitudes. Mathematics educators should explore the use of multimedia to help communicate and develop positive attitudes about mathematics. Not everyone recognizes the message in a sound effect, but multimedia materials can communicate subtle messages about how you should feel or what the developer's attitude is about a message. If mathematics educators are con-

cerned about Barbie's statement "Math class is tough," then they should consider the subtle power of multimedia.

Content Expertise

A project I recently proposed for a team of instructional design students highlighted the need for a balance between content expertise and technology expertise. The project involved enhancing the instructional value of a videodisc about rotational motion from *Mechanical Universe*. Without a rich mathematics and science background, my students struggled to create new ways of communicating visual representations of the three-dimensional reasoning needed to support student learning.

The rotational motion project reinforced my beliefs about the need for content experts, but I also believe that content experts alone cannot design good multimedia instruction. Mathematics educators should beware the marketing hype about the ease of use of new, powerful multimedia authoring systems to develop instructional materials.

Mathematics educators need to look closely at multimedia and acquaint themselves with the expanding capability of multimedia. Learners risk confusion and worse without content expertise guiding the use of multimedia to enhance context, visual displays, and learner attitudes. The message and the medium must work together.

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[1] A videodisc is like a videotape, except with videodisc a teacher can play any part of the video at any time. This random access can be controlled through a remote control, a computer, or other electronic devices.

Problems

Bicycle Tracks

Once while riding on my bicycle along a path, I crossed a strip of wet paint about 6 inches wide. After riding a short time in a straight line I looked back at the marks on the pavement left by the wet paint picked up on my tires. What did I see?

Adapted from Thinking Mathematically by Mason, Burton, and Stacey, 1985.

Fred and Frank

Fred and Frank are two fitness fanatics. On a run from point A to point B, Fred runs half the way and walks the other half. Frank runs for half the time and walks for the other half. They both run and walk at the same speed. Who finished first?

Adapted from Thinking Mathematically by Mason, Burton, and Stacey, 1985.

Fencing Problem

You are trying to build a fence to enclose an area along a river. You have 100 feet of fencing. What shape should you enclose so as to maximize the fenced-in area? What is the maximum area?

This problem was taken from Dr. Wilson's Notebook. Jim Wilson is the Head of the Mathematics Education Department at The University of Georgia.

100!

How many zeros are there at the end of 100!?

Submitted by Steve Messig, a mathematics teacher at Rockdale County High School, Conyers, Georgia. Steve holds a master's degree in Mathematics Education from The University of Georgia.