The Concord Consortium
Realizing the educational promise of technology Winter 1999
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INSIDE

New Technology Bumps Into an Old Curriculum

Does the Traditional Course Sequence Need an Overhaul?

by Robert Tinker

A curriculum is the topics taught, but also the interdependencies that allow concepts to build on what students have previously learned. But the current use of educational technology in the classroom rarely builds on itself. What is needed is a new K-14 curriculum that incorporates technology-based interdependencies as well.

To date, the major implementations of learning technologies have been within the traditional curriculum context: the graphing calculator is used when graphs are addressed in the curriculum, the geometry visualizers are used to improve geometry wherever students usually encounter it, probeware is used to improve conventional labs. Potentially revolutionary technologies have not been used to create fundamental improvements in the traditional sequence of topics

For instance, if technology helps fourth grade students gain an understanding of graphs and decimals, then the entire curriculum thereafter should build on that understanding. If calculus is introduced in middle grades, then high school students should be applying calculus to interesting real-world problems. The well- documented capacity of probeware to allow kids in elementary school to interpret graphs should be used to improve and rethink the teaching of algebra.

Research is needed to learn more about these interdependencies, so we can create alternative curricula that exploit the power of modern learning technologies.

Unrealized Potential

Historians of science have revised their view of the progress of science to account for the huge impact of instrumentation on what could be studied. Whole areas of science were slow to develop because there was no way to observe the phenomena.

Perhaps what we teach has been similarly influenced by what can be measured, represented, and visualized. Without computers, for instance, it is difficult to measure and record many kinds of change. This may account for the absence of a range of topics involving change in the elementary science curriculum. The "technology" that has been universally available has been the use of theory and abstractions. While powerful, this technology may make many concepts available only to older students. New technologies relying on visualizations, interactions, and kinesthetics can make key concepts accessible earlier.

But more often than not in today's classroom, five or more students share a school computer that is unlikely to have network access, and only the most affluent

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The Concord Consortium

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Meet the Board

Our six-member Board of Directors is a diverse association of dedicated and successful professionals committed to expanding educational opportunities worldwide. In the next issue of @CONCORD we will profile the final two board members and their interests. More detailed information about each member is available from our web site.

Rick Abrams is President of Tom Snyder Productions, a successful and highly innovative educational software development and publishing company specializing in social studies, science and math materials for K-8 schools. Its materials are used in over 50,000 schools in the U.S. The company also produces two acclaimed television shows. "Science Court," an animated educational show, can be seen each Saturday on ABC. "Dr. Katz: Professional Therapist" can be seen each Sunday on Comedy Central. Rick has been treasurer of Educators for Social Responsibility for many years and brings a combination of educational, commercial, and financial expertise to the board.

Vivian Day has been active in business, politics and education worldwide. She has successfully engaged in fund raising, strategic planning, and organizational cooperation internationally. She co-chaired a major U.S.-Soviet conference on manufacturing diversification at the American Academy of Arts and Sciences in Cambridge, Massachusetts, and chaired the National League of Women Voters delegation to the World Congress of Women in Moscow. Recently she has worked with the Salzburg Seminar, an international educational seminar in Austria. She is also a founder and board member of the Josef and Petra Varvrousek Foundation, an environmental education foundation in the Czech Republic.

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We dream of an educational system that responds to each person's learning needs. We dream of classrooms where there is collaborative learning. We dream of students and experts working together locally and internationally to solve problems worldwide.

Education is the single most important investment a society can make in its future. Quality education is essential to help people everywhere realize their full potential. The Concord Consortium is a research and development nonprofit organization made up of teachers, curriculum developers, technology experts and innovators committed to stimulating large-scale, technology-based improvement in teaching and learning.

Through the creative and appropriate use of information technologies, we believe our dream of universal quality education is possible.

We are dedicated to realizing the educational promise of technology.

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Geographic Information Systems

Using GIS to Support Sustainable Development Education

by Noah Fields

Rosa Santaiti wants to try something new this year with her students. She wants her high school Spanish class to practice their language skills by talking with the local Hispanic community. They are going to do this by working with them to increase awareness about local recycling efforts.

But Santaiti and her students have a lot of work to do before they begin. First, they need to find out where the Hispanic population lives. Then they need to locate community resources near these neighborhoods. Where are the schools located? Where is the nearest library? Where is the most convenient recycling center?

Eventually, the class wants to create maps and flyers in Spanish showing where the local recycling center is, what days it's open, and what items can be recycled. To accomplish all this, Santaiti's students are excited about using GIS software.

GIS could be used to locate the overlap of schools, industry, and recycling centers within a local community.

Looking at the Future

Santaiti is one of 50 teachers working with The Concord Consortium's Education for a Sustainable Future (ESF) project, which is seeking flexible software tools that can help learners understand critical environmental, economic, and social issues that will affect their communities in the 21st century. Geographic Information Systems (GIS) software is one of those tools.

For years, fields as diverse as disaster relief, crime prevention, and urban planning have used GIS. Now that GIS tools are becoming easier to use, they've caught the attention of educators. Students are using GIS tools to better understand sustainable development, which has been described as "meeting the needs of the present without compromising the ability for future generations to meet their needs," according to the Brundtland report by the World Commission on Environment and Development.

Sustainable development is interesting to students because it involves their own future. "If we are going to engage students and citizens in creating sustainable communities," explains Keith Wheeler, Director of the Center for a Sustainable Future, the division of The Concord Consortium which is coordinating the ESF project, "then we must take advantage of tools like GIS that allow individuals and groups of people to see what the current situation is. What does the future hold? How can the opportunity for proactive planning and design help create a natural and human landscape that is in balance over time?"

Often the biggest problems a community faces involve a number of stake holders, all of whom have interests they want to protect, resources they want access to, and long-term goals and objectives they want to meet. GIS tools are invaluable for decision support, consensus building, data visualization and future planning activities, which are a critical part of sustainable development. By using GIS tools, everyone can explore various proposals and their outcomes in order to find common ground.

What is GIS?

The quickest way to upset a GIS enthusiast is to describe GIS as "mapping software." The phrase brings to mind simpler tools such as MapQuest, which is good for planning a car trip, but is not an open-ended, flexible tool like word processing or spreadsheet software.

But even though calling it "mapping software" limits the GIS definition, it does provide a conceptual starting point for the discussion of GIS. Maps traditionally have been simple reference tools, often two-dimensional images representing features of an area of interest. Usually a map is created for a specific purpose. A road map shows you where the highways are. A city map shows you the street names and maybe the location of local landmarks. Santaiti's students might be able to use such a map to circle the location of schools who might take part in a recycling program. Another map might show the

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LINKS ON THIS PAGE

Education for a Sustainable Future—csf.concord.org/esf
Center for a Sustainable Future—csf.concord.org
Brundtland—gopher://gopher.un.org/00/esc/cn17/1997/off/97- -3.EN
MapQuest—www.mapquest.com

Geographic Information Systems

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location of senior centers or local businesses, but that's about all. Generally maps are passive — they don't change as you work with them.

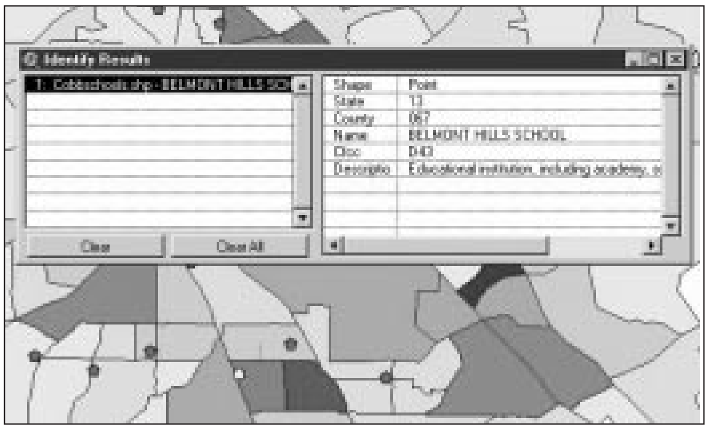
GIS, on the other hand, is an explorer's tool suited for the investigative mind. It supports multiple modes of operation, including map making, data collection, data analysis, decision support, and data visualization, which help answer complicated questions, such as: What will happen if the water level in the river rises ten feet? Which roads will be washed out? Which houses will have to be evacuated? What are the phone numbers of the people who live there?

Santaiti's students are investigating the relationship between recycling, language, education, and the local community. If they create a flyer in Spanish, where should it be distributed? How many people live in the community around the recycling center? Is there a library nearby where flyers can be distributed? GIS can be helpful in answering these questions.

There are two main types of GIS data. "Feature" data shows where things are — "X marks the spot" kind of information. It might describe where the recycling centers are located. "Attribute" data might describe the kinds of items that can be recycled there — newspaper, tin, green glass, cardboard. It might explain the types of plastic that can and cannot be recycled at each center, give a description of each, and even display a photograph of the containers. Once you have some feature data, it's pretty easy to keep recording new attribute data.

GIS uses data layers to control how many features are displayed at one time. A data layer is like a sheet of transparent acetate. Each sheet has a different feature printed on it, such as the contours of local roads or the outline of the school district. As few as one or as many as a hundred data layers can be visible at one time. By turning on and off layers it is easy to compare and identify the relationships between them.

If we add a layer to Santaiti's class project showing where the Hispanic population lives, we can see the proximity



GIS combines mapping with an interactive interface. Learning to use it can be time consuming, but worth the effort.

of the recycling center to the Spanish-speaking community. We can also add data layers for the location of schools and libraries. Another layer can show where businesses are located.

Layering allows you to see the data that you are interested in while hiding the things you don't care about.

Perhaps the most powerful feature of GIS is its ability to perform complex and meaningful queries on all of the data at once. Using the data layers we have mentioned so far, one could ask the data a question, and get a customized image, showing us the location of all Spanish-speaking households which are less than a mile from a recycling center and within walking distance of a school or library. It can also show pictures of what types of items can be recycled at each center. This would be a great map for kids to use in targeting recycling information to the Hispanic community.

Government and Business Use

Federal agencies which are set up to monitor the health, growth, safety, demographics, and natural resources of the country rely on the use of GIS tools to create maps, analyze data, prepare for disasters, and generally gain a better understanding of the physical and sociological nature of the country.

Many of these agencies, such as the Environmental Protection Agency, the U.S. Geological Survey, the U.S. Census Bureau, publish their data in formats that can be easily used. Often they have web sites from which you can download data. In some instances, you can buy a CD-ROM full of information. Many state agencies also make GIS information available. Good local GIS data may be as close as your town hall. Companies use GIS to study consumer demographics or to minimize their environmental impact. Demand for GIS experts in business and government is pushing community colleges and universities to offer GIS courses.

Software Choices

GIS software can be expensive, but ESRI and other software vendors offer competitive prices for the K-12 market. ArcView, the leading GIS software from ESRI, can be purchased for about $200 for a school site license. ESRI and others offer less robust alternatives to ArcView, such as ArcExplorer, which has fewer advanced features but is easier to use, and

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LINKS ON THIS PAGE

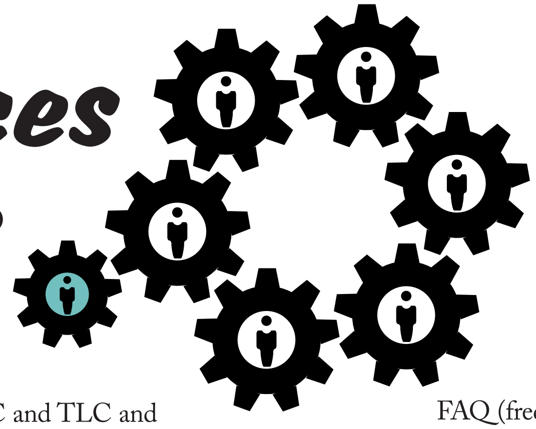
ESRI—www.esri.com

U.S. Census Bureau—www.census.gov

U.S. Geological Survey—mapping.usgs.gov/www/html/1educate.html

Environmental Protection Agency—www.epa.gov

Speaking in Voices



Effective Techniques for Keeping Web Discussions Running Smoothly

by Sarah Haavind

Any online course needs a moderator, but an excellent online course, or netcourse, requires a skilled moderator.

The moderator, or group leader, for an online course does many of the same things a face-to-face group facilitator would, such as guiding a group discussion in a restrained but effective way. But the web-based moderator faces challenges unique to a medium in which the participants are not in the same room and rarely logged on at the same time.

Web moderators have to learn to communicate using different voices, styles and questions that enhance the online group learning process.

Our experience in online moderation comes from two courses which have served hundreds of teachers. INTEC (International Netcourse Teacher Enhancement Coalition) was designed to increase teacher understanding of inquiry as an educational strategy in secondary mathematics and science teaching. It was developed by experts and is offered to groups of 20 teachers led by moderators who are trained to lead online discussions in an inquiry-based environment. The Teacher Learning Conference™ (TLC) supports high school teachers in creating courses for our Virtual High School® (VHS) project.

Model Moderator

Our model of a well-designed netcourse using moderators to shape participant learning has evolved from our experiences with INTEC and TLC and has important implications for any online course.

Currently the most common model is one in which the person who offers the netcourse is the same person who developed or designed it. That person may be skilled at instructional design, but not know much about the best practices for supporting online learning.

This model also limits the opportunity for scaling that the Internet provides. One teacher-moderator cannot effectively handle a class of more than twenty online participants any more than a face-to face teacher can.

High quality netcourses, created by a team of experts or an individual, do not necessarily need to be moderated by the same content developers or course designers. Others — moderators — can be trained to support the course in an online environment.

These moderators might partner with either an expert or a cadre of field experts in a "triage" model of teaching. For example, a netcourse providing software training for teachers could be led by a skilled moderator, but after participants have gained experience using the tool, the moderator might be joined by an expert (such as a biologist or statistician), someone who has used the tool in teaching, or the software designer. For a one- or two-week period, the moderator could be supported by this expert online.

However, even the need for an expert may be replaced by a well-constructed FAQ (frequently asked questions) page or direct pointers to a good quality online "Ask A" service, such as the Virtual Reference Desk.

The moderator's role may vary from model to model, but effective online moderation must be grounded in several key pedagogical principles, which we outline in our forthcoming book, *Web Moderating*.

Moderator Skills

In order for learning to take place in a netcourse, the online discussion group is critical. The quality of learning that takes place here is highly dependent on the skills of the group leader, or moderator, who must make effective but restrained interventions to steer a group's learning process in the right direction.

Web Moderating is designed to expand the effectiveness of moderators by providing new ways to think about WHEN and HOW to intervene in an ongoing discussion among participants.

Key skills involve deepening dialogue and focusing learning. Strategies include the use of a variety of voices, styles, and questions that get at underlying assumptions or at the commonalities among apparently disparate points made by discussion participants.

Good meeting facilitators already know many of these skills, which are essential in the repertoire of strategies for anyone successfully moderating a net-

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LINKS ON THIS PAGE

INTEC—intec.concord.org

Virtual Reference Desk—www.vrd.org

Teacher Learning Conference—vhs.concord.org/Pages/Main+Office-Want+to+Join

Virtual High School—vhs.concord.org

Monday's Lesson

Technology-Enhanced Exercises for the Classroom

"Using AgentSheets"

by Robert Tinker

Many issues in public policy depend on mathematical models. Will there be a population explosion? How much will the earth warm? How many students will enroll in your school next year?

The answers to these questions depend on models and the assumptions that go into models. Increasingly, the political debate is about the fine points of modeling. The statement "Global warming is expected to increase the average earth temperature five degrees next century" is based on models whose assumptions are hotly debated. There is little question that effective citizenship requires increasingly sophisticated knowledge of models.

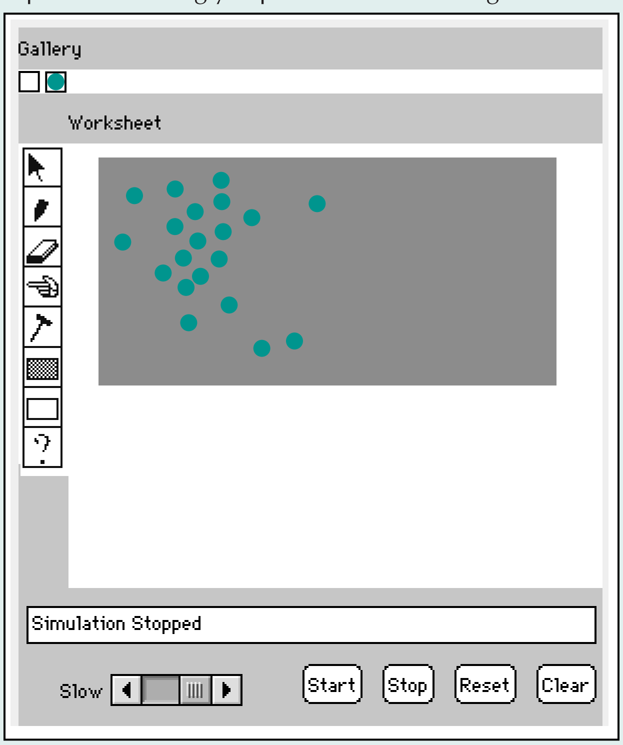

Figure 1. A simple population model built from AgentSheets.

Students need to know what makes a good model, what constitutes "proof" of a model's accuracy, and how to judge a model's predictive value. Can you trust a model that makes simple assumptions that are clearly inaccurate? Can you believe the results of a model if you don't understand the mathematics it uses? These and other questions are best addressed by giving students increased exposure to thoughtful modeling activities.

How do we do this?

Students should progress through at least three major stages in learning to use models: running models that others have made, modifying models, and making original models. To reach this level of generality, students need to explore models in the context of many different situations and using different modeling tools.

One relatively recent kind of model that has fascinated mathematicians and scientists is based on elements, called cellular automata. They obey very simple rules that depend mostly on themselves or their local environment. In spite of using simple rules, complex group behavior can result. Fire, population, and many other systems can be analyzed in these terms. The game Life was the first well-known computer-based system to use cellular automata. In this system, amazingly simple rules result in interesting and complex behavior.

Until recently, students could use models such as Life, but they didn't have access to systems they could modify or program themselves. StarLogo and AgentSheets have corrected that problem.

AgentSheets is simple because it uses an intuitive visual programming language. StarLogo is a more serious and complete language that will be the subject of a later article. Currently both are free on the Web.

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LINKS ON THIS PAGE
StarLogo—www.media.mit.edu/starlogo
Life—www.astro.virginia.edu/~eww6n/math/Life.html
AgentSheets—www.agentsheets.com

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Learn techniques of envisioning different futures, understanding systems and how they work, and developing strategies for moving toward a sustainable future. Software modeling tools and related Web resources are introduced.

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The Virtual High School® has gained international recognition for creating virtual classrooms that are innovative and effective. VHS Services can help schools, colleges, universities and states create their own online classroom.

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Staff Orientation. We offer workshops for school and program administrators on virtual schooling policies, schedules, teacher and student selection, and virtual class management.

Technical Services. We can train your staff in technical assistance and help them to understand server management or contract these services.

Quality Assurance. We have standards and procedures for measuring the quality of NetCourses, teachers, facilities, and projects. We can administer these evaluations or train others.

VHS Services also offers individual course topics. Periodically throughout the year we offer open registration for these courses.

Developing Online Training and Instruction: An Overview of Technology & Pedagogy

Distance learning, distributed learning, netcourses, online education, Web-based education, virtual courses — learn about the classroom of the future during this overview of the growing field of Internet-based education.

Online Moderation: Supporting Learning in Virtual Communities

The learning that takes place in online discussion groups critically depends on the skills of the group leader or moderator. Effective intervention is important for guiding group learning. This topic is based on our experience moderating online teacher professional development courses.

Online Teaching

Learn about teaching strategies, standards, student evalutions, and scheduling for online teaching in this intensive 125-hour graduate-level NetCourse using Lotus LearningSpace.

COLLABORATION

CC Services offers collaborative opportunities for individuals or organizations wishing to extend their programs through a long-term relationship with the research and development efforts of The Concord Consortium.

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We help faculty and teachers wanting to study their own educational innovations put together customized collaborative educational research projects.

CC Services

CC Services is a division of **The Concord Consortium**, a nonprofit educational research and development organization run by educators, curriculum developers, technology experts, and researchers who are dedicated to the development and wide distribution of **innovative educational tools** worldwide. Through CC Services we offer NetCourses — classes offered online — and workshops to help educators implement **technology-rich educational strategies**. We also provide public speakers, consultation and **collaborative projects** to help administrators, staff and teachers implement the educational promise of technology.

New technological resources are **powerful tools** for making quality education available to all people. The Concord Consortium is committed to achieving **excellence in education** by using the best in technology.

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The Concord Consortium

Realizing the educational promise of technology

Monday's Lesson

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Using Models

Figure 1 (page 6) shows a simple Population Model built from AgentSheets. To begin the simulation, click Start. The dots move around at random and die off 1% of the time, while giving birth to new dots 2% of the time. As you might predict, the dot population explodes.

Although not very sophisticated, this simulation can teach students a lot about exponential growth.To start over:

1. Click Stop.
2. From the Gallery select the background button.
3. Select the Hammer tool and click inside the rectangle to clear the dots.
4. From the Gallery select the dot button.
5. Select the Pencil tool and click inside the rectangle to create another dot.
6. Click Start.

The new dot sometimes makes another dot or, less frequently, dies. Although death is less frequent than birth, sometimes a population of 1-3 dots will die out. This shows that exponential growth is not a good approximation for small populations.

Modifying Models

You can modify the model to simulate different circumstances, such as the first Asians migrating to the Americas (Figure 2).

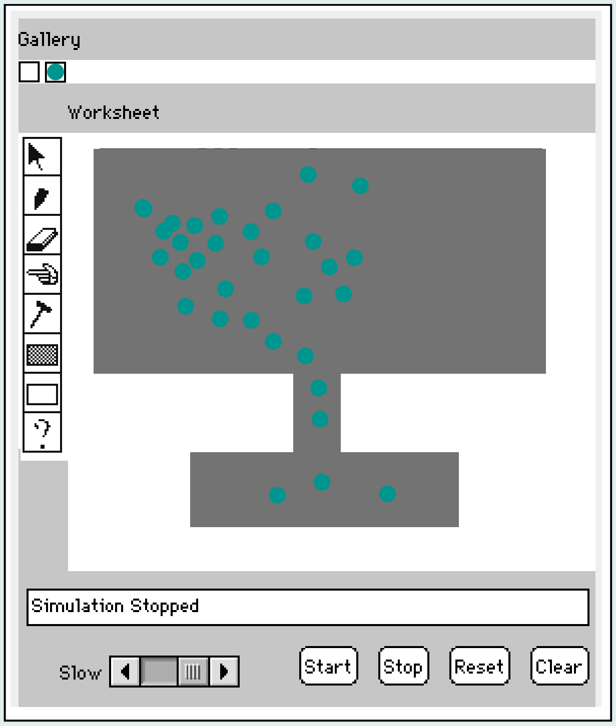

Figure 2. This model shows the effect of populations migrating from one continent to another.

1. Click Stop and then Clear to remove the background and dots.
2. From the Gallery select the background button.
3. Select the Rectangle tool and draw two "continents" with a bridge between them.
4. From the Gallery select the dot button.
5. Select the Pencil tool and click inside one of the backgrounds to create a dot.
6. Click Start to see the migration of dots across the "land bridge."

Now you're ready to look at how the simulation is built. Download AgentSheets and then open Pop1. Take a look at the guts of this simulation program. Note how it reads through a list of commands until it finds an "If" condition that is true and executes its "Then" condition. This is what happens when the simulation starts:

1. 2% of the time the dot makes a new dot above itself.
2. If it doesn't make a new dot, 1% of the time it dies.
3. If it doesn't take option 1 or 2, the dot moves randomly to an adjacent background square.

You can easily change the population growth by changing the percentages. Explore what happens when the two percentages are equal or when the birth rate is smaller than death rate.

Some things about this model need improvement, such as a factor to control overcrowding. At this point, you're about to cross the line between modifying an old program and creating a new one.

Making Models

You can create a population model that stops growing when it gets too crowded or resources are depleted. But for this you'll have to change how the model is programmed. Go to our Population Model web site and follow the instructions for adding a clause to the AgentSheets program in order to create dots 2% of the time, but only if there is space for the offspring.

Models like these raise important issues about population growth while giving learners valuable experience in modeling.

A great way to start Monday morning! @

Robert Tinker is President of The Concord Consortium. For more information on modeling, see his paper "Teaching Theory Building." Bob@concord.org

LINKS ON THIS PAGE

Population Model—www.concord.org/population
AgentSheets—www.agentsheets.com
Teaching Theory Building—www.concord.org/library/papers.html
Pop1—www.concord.org/population

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third of students have computers at home. Available computers sometimes do not work and too often they lack a full suite of software. This low and unreliable access to technology means that students do not get enough experience to master complex software tools and teachers cannot assign homework that assumes ready computer availability.

Important technology-rich curricula materials are rarely implemented, if at all, because there is insufficient access to technology and schools are unable to rearrange the curriculum to exploit the advantages of these materials. In this environment, the full potential of information technologies in education cannot be realized.

Ubiquitous Technology

We will soon have student widespread access to technologies that could revolutionize learning. The next decade is certain to see the underlying costs of computation and networking drop by a factor of ten. The ubiquitous availability of computation and networking could make it possible for every student to have full-time access to portable, networked computational resources. When this happens, technology utilization patterns in schools will change dramatically from today's occasional use of simple applications to essentially continuous use of a suite of powerful tools.

Widespread use of technology will cause advances in learning that require changes in the structure of curricula. If technology makes it possible to teach difficult central concepts earlier and with greater understanding, then the traditional sequence of topics needs a complete overhaul. This kind of change mirrors the changes technology has caused in business where jobs, organizational structures, and information flows have been altered dramatically.

Demonstrated Success

Researchers exploring the impact of information technologies on learning have many examples of approaches that allow students to learn far more, better, and earlier. Students in early elementary grades can use probeware to learn decimals and to interpret graphs. Important concepts of rate and change can be learned at surprisingly early grades with SimCalc and ThinkerTools. Middle school students can create dynamic models using Model-It, Stella, and spreadsheets. Graphing software, symbolic equation evaluators, Logo, image analysis, data analysis and statistical packages, CAD tools, 3D renderers, supercomputers serving computationally intense results and visualizations, and GIS (see article page 3) all have demonstrated capacities to make important contributions to improved student understanding.

Potentially revolutionary technologies have not been used to create fundamental improvements in the traditional sequence of topics.

While there are indications of the educational importance of these individual innovations, they are usually studied in isolation from each other and implemented within current curricula frameworks. To fully exploit ubiquitous student access to computers and networking, we need to string computer-empowered units together into strands so that later learning builds on earlier experiences.

Curriculum Strands

It is unlikely that the entire curriculum would be changed even if compelling research data on the effectiveness of technology were generated. A more flexible and less threatening way of changing the curriculum is to insert technology-enhanced curriculum strands. These strands would involve sequences of activities that span grades and build upon each other. The following are some possible candidates.

Macro/Micro Connections

We anticipate major gains in science learning by having learners understand the relationship between atomic, nano, and macro views of the same system. If students can build firm, early intuitions about atoms, molecules, and their interactions, huge chunks of later science could fall into place, including chemistry, heat and temperature, gas behavior, state changes, biochemistry, and physical properties.

Design

Technology intuition and skills can be fostered through models, visualizations, CAD, Logo, Crickets, electronics, and probes. To introduce the technology of measurement, students might start with the idea that many things have numbers associated with them that we can measure. The idea that functional models can be used to construct things can be illustrated by programming, electronics, and building. Design challenges can be based on creating apparatus for science experiments.

Exploration

Probes interfaced to good software, sensors with logging electronics, image and video analysis tools, and network

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Crickets—www.legomindstorms.com
Stella—www.hps-inc.com
ThinkerTools—thinkertools.berkeley.edu:7019
Model-It—st2.yahoo.com/cogitodirect/modelit.html
SimCalc—www.simcalc.umassd.edu

databases provide unprecedented opportunities for students to learn how scientists explore the world. A host of important investigative skills such as experiment design, data analysis, treatment of deviations, data interpretation, error analysis, peer collaboration, and communication of results all become important and increasingly familiar as students have more opportunities to experiment using networking and technology-based tools.

Projecting the Future

Students are fascinated by their future and the future of society. With appropriate software tools, learners can investigate population growth, economics, resource limitations, planning, environmental changes, sustainability, and other trends that seem hidden given the scale of the students' age and experience. Simulations, visualizations, and online gaming can give students an intuitive understanding of these issues.

Math of Change

Early experimenting with rates and flows can lead students to understand key concepts in calculus which are fundamental to much of science. Students who understand the mathematics of change are able to intuitively comprehend far earlier ideas central to most science disciplines.

Modeling

Increasingly, computer-generated models frame public debates, determine investments, and report scientific discoveries. Students need an understanding of how to use, evaluate, test, modify, and create different kinds of models.

Need for Research

Over the next few years as learning technologies become more widespread, the disparity between what could be taught making full use of technology and what is actually taught in most classrooms will become increasingly intolerable. The problem is that creating new sequences for teaching is a massive effort that requires a broader research base and extensive experience.

The most important finding of the report on educational technology by the President's Committee of Advisors on Science and Technology (1997) was that, while there were many exciting and promising examples of educational technologies, there were insufficient data on which to base a major, multi-billion dollar national effort. The report calls for "early-stage research aimed at developing new forms of educational software, content, and technology-enabled pedagogy."

We desperately need research-based responses that are reliable enough to use as the basis for policies that may well influence an entire generation of learners. One cannot experiment casually with what students should learn, for fear of missing critical concepts or undermining student motivation. Yet the research community that has created the possibility of vastly improved learning must undertake this work or see its vision unrealized and the educational potential of technology unused. @

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Tinker—www.concord.org/library/papers.html

Online Moderating

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course. An effective moderator is able to create an environment in which participants together generate understandings that are powerful and lasting.

Voice

One moderating strategy described in the *Web Moderating* chapter "Strategies in Service of Dialogue," is the use of voice. A moderator can employ a variety of voices to bring a dialogue to a deeper or more focused level.

The moderator may wish to assume a voice appropriate to one of many roles such as the "teacher on Monday" (flush with new ideas), "teacher on Friday" (enthusiasm chastened but yet hopeful), or a concerned parent from a personal perspective.

To enhance the instructive quality of an intervention, a skilled moderator can use the role or character identification voice to introduce necessary alternate perspectives into the dialogue without concern for personal ownership or direct confrontation of participants.

A role or character identification voice may seek to:

- Introduce or validate multiple perspectives on key issues.
- Highlight or introduce, through characters or tales, points that were omitted or may need reinforcing.
- Indicate levels of importance of lines of thought or concepts through narrative means.
- Weave and integrate into the main discussion some ideas that may seem irrelevant but, when observed through another perspective, indicate valid and focused lines of thought.

The Future

As more schools and businesses use netcourses to enhance course offerings or prepare employees, it is essential that professors, teachers or corporate instructors leading such communities be trained in useful tools for moderating online learning and that they consider scaling their course offerings by having others, skilled at moderating, lead their courses.

There are important differences between leading a course in person and moderating an online netcourse. Recognition of these differences, and the inherent opportunities of the Internet as the new medium, taps the true potential of the netcourse model. @

Sarah Haavind is the Curriculum Design Coordinator for the INTEC project. Web Moderating *will be published by Plenum Press in 1999 as part of their Innovations in Science Education and Technology series. Sarah@concord.org*

Geographic Information Systems

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it's free! ArcVoyager is another inexpensive ESRI product. Before making an expensive purchase, take a look at the freebies.

Keep in mind that GIS is a challenge. The time commitment required to become comfortable using it is a serious consideration. The ESF project will be developing a more intuitive "Visual Community Designer" tool which incorporates some of the capabilities of robust GIS applications.

Learning Opportunities

GIS tools work well with a project-based education. A student using GIS to study a local river can create a light green map layer showing higher concentrations of dissolved oxygen and a dark blue layer showing lower concentrations. Now that the student has entered her data and chosen a visualization scheme, she can begin to notice trends. Is there a relationship between higher concentrations of water contaminates and neighboring roads? Add a map of the roads and find out. While many people are confused by lists of numbers or even charts and graphs, most people could read this student's map and understand its environmental implications.

In some instances, the data a student creates can be valuable to local agencies. Students at Osborne High School in Osborne, Georgia, are looking at teen pregnancy and drug use in their high school. They're partnering with other community organizations, such as the police department, the school board, and churches to create useful information. Students will help the police department, which has only handwritten reports, to code the crime statistics on a map of the community. This information will be correlated with school location and other community resources. As a result, the police will be better informed, and the students will have made an investment in their community.

There are countless creative uses for GIS in the classroom. GIS is just one example of how information technology, when used appropriately, can help students understand complex real-world issues. @

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LINKS ON THIS PAGE

INTEC—intec.concord.org

Plenum Press—www.plenum.com

ESF—csf.concord.org/esf

Perspective

Sharing VHS with the World

by Robert Tinker

> "More districts and even states want to join than we can support with our original funding."

In the twenty years I have been doing research and development on the ways technology can improve education, rarely has an idea gained acceptance as quickly as our Virtual High School® (VHS) project.

By most measures — participant satisfaction, growth, publicity, interest — VHS is in a league by itself. Three years into a five-year grant, we already have reached our major milestones. We now are in the unaccustomed position of trying to satisfy more demand than our funding anticipated.

The key to VHS success is its cooperative nature, in which schools who contribute courses can enroll students in any of the courses offered by other schools. Because of our organizational structure, there is no tuition and no increase in the teaching load. This year, 34 schools are offering 40 courses to about 500 students in these schools. More districts and even states want to join than we can support with our original funding. To respond to this interest, we have created two options for new participants.

A limited number of schools can join the funded VHS project. Preference will be given to schools that increase the diversity of participating students. Groups of schools can join the project, but if the group is larger than four schools, we have to charge a fee for our costs. This strategy will allow us to expand to over 200 schools in the last year of funding, with approximately 300 teachers prepared to teach NetCourses when the funding ends in summer 2001.

Groups can create their own VHS cooperatives. Our service arm, CC Services, is prepared, through fee-based workshops and services, to transfer our experience, technology, administrative knowledge, and professional development materials to projects that want to create their own VHS. Our dream is that our VHS project will become only one of several sister VHS cooperatives, all using similar technologies and structures and sharing high-quality courses. Some of the new VHS projects might be administered by large districts, intermediate units, or states. In addition, hardware vendors, associations of schools, or educational units within other countries might sponsor other VHS cooperatives. While many students would take NetCourses within their cooperative, others might register for unusual courses offered by other cooperatives. Courses would be free for most students because they would be offered by schools in exchange for the right to enroll their own students in other courses. Some entrepreneurial schools might, however, charge tuition. This might serve students who do not belong to cooperating schools or it might be a way of coping with over-enrollment in very popular courses.

The key to making an expanded VHS work will be shared standards for NetCourse design, course quality, and teacher preparation. In our first @CONCORD I made a call for voluntary standards. More recently, we created a NetCourse Evaluation Board representing a broad range of educators. This effort will culminate in a set of VHS standards that can serve as voluntary quality standards for all online courses.

It is sometimes difficult to move educational developments from the lab into wider use. Sometimes that's because developments deserve to die. Others should be turned over to companies who have the resources and orientation to create large-scale products. For VHS, however, this is not feasible.

Our plan for expanding the VHS project on a fee basis, while simultaneously seeding new projects, is a unique dissemination strategy which we think can benefit everyone. @

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Virtual High School—vhs.concord.org
@CONCORD—www.concord.org/library/newsletter.html
NetCourse Evaluation Board—zonorus.marlboro.edu/~augustap/vhsnews/vhsnewsindex.htm#NCEBmeeting

Join Us Online

U.S. News & World Report

Read about Virtual High School (VHS) teacher David Jost in the January 4, 1999, issue of U.S. News & World Report (page 68). Jost, a music teacher at Westborough High School near Worcester, Massachusetts, was one of 18 individuals profiled as part of the magazine's "American Innovators" section, which highlighted people "giving life and form to new thoughts." This is Jost's second year teaching "Music Appreciation and Composition" online to VHS students.

VHS is a Technology Challenge Grant funded by the U.S. Department of Education to The Concord Consortium and Hudson Public Schools in 1996. It now has 500 students in 32 urban and rural high schools and 2 colleges located in 12 states.

http://www.usnews.com/usnews/issue/981228/28jost.htm

Technology in Education Conference

If you are interested in participating in research on technology in education, come to the conference of the Center for Innovative Learning Technology, CILT99, April 29 to May 2, 1999, in San Jose, California. The conference combines plenary sessions with working sessions in CILT's thematic areas. It is an opportunity to meet with leaders in the field of learning technologies, define agendas for future innovation, and forge new partnerships that may be eligible for CILT grant funding.

http://www.cilt.org

Computerworld Smithsonian Award

In December the Virtual High School (VHS) was nominated for the Computerworld Smithsonian Award which highlights people who have "achieved outstanding progress for society through the visionary use of information technology." Nominees are showcased at the Smithsonian Institution's National Museum of American History in Washington, D.C. Information about the award winners since 1989 is catalogued in the Smithsonian's Permanent Research Collection on Information Technology, which is a primary resource for chronicling the impact of information technology on society.

http://innovate.si.edu

Vitual High School®

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http://vhs.concord.org

Streaming Video

VStream and The Concord Consortium have teamed up to display the latest in video streaming by showing the 12-minute video "Opening Doors" about the U.S. Department of Education's Technology Challenge Grant Northeast Cluster. The video will be available for web-based viewing until the end of March. Tell us what you think of the technology by filling out our brief online survey.

http://notes.concord.org/concord-web/videopoll.nsf/poll

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