

### Home

The math and science technology integration module is meant for use either after completion of the Project-Based Learning module and Technology Integration module or with participants who are familiar with both modules. This module is designed for a two- to three-hour class or training. It can be used in conjunction with trainings of software applications that are used in classroom settings. Ideally, the module would be the core of a training where participants develop ideas, go back to their classrooms to implement them, and then come back together to regroup, reflect, and refine projects designed at the first training session.

Part One, **Guided Process**, is a brief introduction to technology integration into math and science. It answers the questions "Why do we need to integrate technology into Math and Science Curricula?" "What does it mean to integrate technology into Math and Science?" and "How can technology be integrated into Math and Science Curricula?" These questions are generically addressed in the Technology Integration module. In this module, the curriculum will elicit the responses.

Part Two, **Group Participation**, guides participants in envisioning technology integration in math and science. It asks participants to visit various educational Web sites. The participants are then asked to brainstorm ideas for technology integration in the areas of math and science garnered from visiting and discussing these sites. Ideally, they will design projects and assessments that they can take back to their students and their classrooms. The tasks will be accomplished using group collaboration and hands-on use of technology -- the Internet, computers, software applications, CD-ROMs, scanners, printers, digital cameras, any and all technology resources that are available on the training site.

The PowerPoint® presentations found in the Resources section can be used to introduce the module, or can be used as stand-alone presentations.

The following ISTE NETS Standards have been addressed in this module:

#### I. Technology Operations and Concepts

- a. Demonstrate introductory knowledge, skills, and understanding of concepts related to technology (as described in the ISTE National Education Technology Standards for Students).
- b. Demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies.

#### II. Planning and Designing Learning Environments and Experiences

- a. Design developmentally appropriate learning opportunities that apply technology-enhanced instructional strategies to support the diverse needs of learners.
- b. Apply current research on teaching and learning with technology when planning learning environments and experiences.
- c. Plan for the management of technology resources within the context of learning activities.

#### III. Teaching, Learning, and the Curriculum

- a. Facilitate technology-enhanced experiences that address content standards and student technology standards.
- b. Use technology to support learner-centered strategies that address the diverse needs of students.

- c. Apply technology to develop students' higher order skills and creativity.
- d. Manage student learning activities in a technology-enhanced environment.

#### IV. Assessment and Evaluation

- a. Apply technology in assessing student learning of subject matter using a variety of assessment techniques.
- b. Use technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning.
- c. Apply multiple methods of evaluation to determine students' appropriate use of technology resources for learning, communication, and productivity.

To find the specific standards for your state visit emTech's Web site that links to all state departments of education.

#### Getting Started:

PDF files can be viewed on a wide variety of platforms -- both as a browser plug-in and a stand-alone application -- with **Adobe's free Acrobat Reader®** program. Follow the link provided below for installation instructions.

The videos on this Web site require that you have the **QuickTime Player** installed on your computer. Although most of the video and audio material will play reasonably well on older versions of QuickTime, we strongly recommend that you have QuickTime version 5.0.2 or later installed on your computer for an optimal viewing/ listening experience. If you need help determining whether or not you have the appropriate version of QuickTime installed (and installed properly), check out Apple's "Installation Check" Web page. To find answers to support questions often asked by QuickTime users, visit Apple's QuickTime

Support Web page. To download QuickTime, click on the link provided below.

To download a free version of the Microsoft®: PowerPoint Viewer®, visit Microsoft's Download Center at the links provided below.

*Acknowledgements:* GLEF extends our thanks to Sara Armstrong, Consultant, Berkeley, California.

#### The following Web sites appear on this page:

##### **ISTE NETS Standards:**

[cnets.iste.org/teachers/t\\_stands.html](http://cnets.iste.org/teachers/t_stands.html)

**emTech:** [www.emtech.net/states.htm](http://www.emtech.net/states.htm)

**Apple's Installation Check Web page:**  
[www.apple.com/quicktime/troubleshooting/](http://www.apple.com/quicktime/troubleshooting/)

**Apple's QuickTime Support Web page:**  
[www.info.apple.com/usen/quicktime/](http://www.info.apple.com/usen/quicktime/)

**Download Adobe Acrobat Reader:**  
[www.adobe.com/products/acrobat/readstep2.html](http://www.adobe.com/products/acrobat/readstep2.html)

**Download QuickTime:**  
[www.apple.com/quicktime/download/](http://www.apple.com/quicktime/download/)

**Download Microsoft PowerPoint Viewer (Windows):**  
[office.microsoft.com/OfficeUpdate/default.aspx?displaylang=EN](http://office.microsoft.com/OfficeUpdate/default.aspx?displaylang=EN)

**Download Microsoft PowerPoint Viewer (Mac):**  
[www.microsoft.com/mac/downloads.aspx?pid=download&location=/mac/download/office98/powerpoint98viewer.xml&secid=20&ssid=7&flgnosysreq=False](http://www.microsoft.com/mac/downloads.aspx?pid=download&location=/mac/download/office98/powerpoint98viewer.xml&secid=20&ssid=7&flgnosysreq=False)

## Why Do We Need to Integrate Technology into Math and Science Curricula?

"Four important and enduring reasons underscore the need for our children to achieve competency in mathematics and science:

- The rapid pace of change in both the increasingly interdependent global economy and the American workplace demands widespread mathematics- and science-related knowledge and abilities.

- Our citizens need both mathematics and science for their everyday decision making.

- Mathematics and science are inextricably linked to the nation's security interests.

- The deeper, intrinsic value of mathematical and scientific knowledge shape and define our common life, history, culture. Mathematics and science are primary sources of lifelong learning and the progress of our civilization."

-- Glenn Commission Report, p. 7

Integrating math and science brings together two very important academic subject areas, and enhances both. This combination better reflects the place of mathematics and science in the real world, and it provides students with a context for how they will use what they're learning once they finish school. By integrating math and science curricula through an inquiry-based approach, teachers build a strong framework for both subjects.

Teaching that uses current inquiry-based approaches can be more effective when technology is thoughtfully integrated. Technology enhances math and science instruction by allowing students to explore math and science concepts that might be too tedious, difficult, or costly to tackle without technology. Technology provides access to up-to-date information available on the Internet, as well as tools for visualizing and modeling, collecting and analyzing data, and communi-

cating ideas. For example, simulations of the challenges inherent in space travel allows students to experience mathematical and scientific problems in the same way mathematicians, astronauts, and other scientists encounter them.

Numerous excellent reports provide more in-depth information about the relationships among math, science, and technology:

- ♦ Executive Summary: Before It's Too Late: A Report to the Nation from the National Commission on Mathematics and Science Teaching for the 21st Century
- ♦ Trends in International Mathematics and Science Study (TIMSS): Trend data based on student assessments in 1995, 1999, and 2003.
- ♦ TIMSS Video Studies
- ♦ National Council of Teachers of Mathematics (NCTM)
- ♦ NCTM Standards
- ♦ Elementary School Highlights
- ♦ Middle School Highlights
- ♦ High School Highlights
- ♦ National Science Teachers Association (NSTA)
- ♦ The Elementary Science Classroom
- ♦ The Middle School Science Classroom
- ♦ The High School Science Classroom
- ♦ National Assessment of Educational Progress (NAEP)

- ♦ California Science Project Lesson Study
- ♦ WestEd Mathematics, Science, and Technology
- ♦ WebMath: Professional development for middle school math teachers
- ♦ Partnership for 21st Century Skills

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**The following Web sites appear on this page:**

**Executive Summary: Before It's Too Late: A Report to the Nation from the National Commission on Mathematics and Science Teaching for the 21st Century:**

[www.ed.gov/inits/Math/glenn/toolate-execsum.html](http://www.ed.gov/inits/Math/glenn/toolate-execsum.html)

**Trends in International Mathematics and Science Study (TIMSS):** [nces.ed.gov/timss/](http://nces.ed.gov/timss/)

**TIMSS Video Studies:**

[www.lessonlab.com/timss1999/](http://www.lessonlab.com/timss1999/)

**National Council of Teachers of Mathematics (NCTM):** [www.nctm.org/](http://www.nctm.org/)

**NCTM Standards:** [www.nctm.org/standards/](http://www.nctm.org/standards/)

**Elementary School Highlights:**

[www.nctm.org/elementary/index.asp](http://www.nctm.org/elementary/index.asp)

**Middle School Highlights:**

[www.nctm.org/middle/index.asp](http://www.nctm.org/middle/index.asp)

**High School Highlights:**

[www.nctm.org/high/index.asp](http://www.nctm.org/high/index.asp)

**National Science Teachers Association (NSTA):** [www.nsta.org/](http://www.nsta.org/)

**The Elementary Science Classroom:**

[www.nsta.org/elementaryschool](http://www.nsta.org/elementaryschool)

**The Middle School Science Classroom:**

[www.nsta.org/middleschool](http://www.nsta.org/middleschool)

**The High School Science Classroom:**

[www.nsta.org/highschool](http://www.nsta.org/highschool)

**National Assessment of Educational Progress (NAEP):** [nces.ed.gov/nationsreportcard/about/](http://nces.ed.gov/nationsreportcard/about/)

**California Science Project Lesson Study:**

[csmf.ucop.edu/csp/resources/lessonstudy.html](http://csmf.ucop.edu/csp/resources/lessonstudy.html)

**WestEd Mathematics, Science, and Technology:**

[www.wested.org/cs/we/view/pg/14](http://www.wested.org/cs/we/view/pg/14)

**WebMath:** [mmap.wested.org/webmath/](http://mmap.wested.org/webmath/)

**Partnership for 21st Century Skills:**

[www.21stcenturyskills.org/](http://www.21stcenturyskills.org/)

## What Does It Mean to Integrate Technology into Math and Science?

The availability of tools and knowledge of their proper use aids in getting a job done. Nothing could be truer when describing the use of technology tools in school. While it's true that public education has done a fine job of educating students for years without them, it's also the case that properly used technology tools can deepen understanding, allow students to explore subjects in ways impossible without them, and help prepare students for the tools they will be using for the rest of their lives -- in the workforce as well as at home.

Mathematicians and scientists were among the first to see the value of technology tools for their own work, and they have pushed the development of meaningful tools in many areas. For example, space science would not be as advanced as it is today without an array of instruments and data collection and analysis tools that allow the deployment and safe return of probes and other spacecraft, and also supply data for analysis while missions are in flight.

The following resources from The George Lucas Educational Foundation provide examples of technology integration into math and science curricula. The focus, as always, should be on the teaching and learning -- what we expect students to know and be able to do when their math or science class is over. As you read the following articles and view the film segments, here are some questions to consider:

- ♦ What evidence do you see and read that technology tools are being used effectively?
- ♦ What evidence do you see and read that curriculum standards are being addressed?
- ♦ How would you adapt what you see and read to your own classroom and school?
- ♦ What other topics that enhance math and science integration with technology came up (for example, project-based learning, school-

- to-career programs, emotional intelligence)?
- ♦ What methods of assessment will you use to determine if your students are learning what you want them to learn?
- ♦ What methods of assessment will you use to determine how technology integration into math and science make a difference in student achievement?
- ♦ How can you share with your colleagues what you're doing, for the purpose of expanding their understanding and yours?

### **The Maine Event**

Maine's provision of a laptop for each of its 33,000 middle school students: "The best thing they've ever done in education."

*Published: 12.16.2003*

### **Biotech Academy: Challenging Assumptions and Changing Lives**

Students enter Biotech Academy in San Jose, California, with low expectations of themselves. They graduate with college acceptances and scholarships.

*Published: 10.1.2003*

### **Geometry in the Real World: Students as Architects**

Students in Eeva Reeder's geometry class design schools for the year 2050, with guidance from two Seattle architects.

*Published: 2.11.2002*

### **Handhelds Go to Class**

A suburban Chicago school district takes the lead in outfitting teachers and students with personal digital assistants.

*Published: 3.12.2002*

### **Classrooms Without Boundaries**

At West Hawaii Explorations Academy, students develop and manage their own projects, with guidance from mentors in the community.

*Published: 11.1.2001*

### **More Fun Than a Barrel of ... Worms?!**

You can't tear students at Newsome Park Elementary School away from their schoolwork when it involves in-depth applications with real-world implications.

*Published: 10.1.2001*

### **A Change in Attitude**

High-tech gadgets such as GPS systems and probes catch students' interest at Harrison Central High School.

*Published: 4.1.2003*

### **Laptops for All**

A commitment to projects and widespread use of laptop computers has spelled success for students at The Mott Hall School in New York City.

*Published: 11.1.2001*

### **A Change in Attitude:**

[www.glef.org/modules/modarticle.php?id=Art\\_1029&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_1029&mod=ms)

### **Laptops for All:**

[www.glef.org/modules/modarticle.php?id=Art\\_895&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_895&mod=ms)

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### **The following Web sites appear on this page:**

#### **The Maine Event:**

[www.glef.org/modules/modarticle.php?id=Art\\_1119&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_1119&mod=ms)

#### **Biotech Academy: Challenging Assumptions and Changing Lives:**

[www.glef.org/modules/modarticle.php?id=Art\\_1060&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_1060&mod=ms)

#### **Geometry in the Real World: Students as Architects:**

[www.glef.org/modules/modarticle.php?id=Art\\_909&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_909&mod=ms)

#### **Handhelds Go to Class:**

[www.glef.org/modules/modarticle.php?id=Art\\_955&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_955&mod=ms)

#### **Classrooms Without Boundaries:**

[www.glef.org/modules/modarticle.php?id=Art\\_885&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_885&mod=ms)

#### **More Fun Than a Barrel of ... Worms?!:**

[www.glef.org/modules/modarticle.php?id=Art\\_860&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_860&mod=ms)

## How Can Technology be Integrated into Math and Science Curricula?

### Math

Since technology is always tied with curriculum, the first step for integrating technology into math classes is to look at the standards. Once it's clear what we want students to know and be able to do, we can look at ways technology tools might enhance their experience. The rest of this section refers to work done at the national level. If you correlate these ideas with your state and local standards, you will see how the resources suggested here can support classroom work.

#### Grades PreK-2

At the Web site for the National Council of Teachers of Mathematics (NCTM), standards for children in preschool through second grade include encouraging parents and other caregivers to engage young children in thinking about numbers, counting, and other early math concepts in casual, easy ways.

"Adults can foster children's mathematical development from the youngest ages by providing environments rich in language and where thinking is encouraged, uniqueness is valued, and exploration is supported."

Play is children's work. Adults support young children's diligence and mathematical development when they direct attention to the mathematics children use in their play, challenge them to solve problems, and encourage their persistence.

An example of an activity that applies this standard, Spoonytunes, found on the NCTM Web site, offers an estimation problem for young children. In this activity, children are challenged to estimate the number of spoons in their silverware drawers at home, then go home and count them. Graphs could be built of estimates and actual counts for different kinds or sizes of spoons (say, metal, plastic, mixing, or measuring spoons, or teaspoons and tablespoons).

#### Grades 3-5

NCTM states, "A major goal in grades 3-5 is the development of computational fluency with whole numbers. ... This set of Standards reinforces the dual goals that mathematics learning is both about making sense of mathematical ideas and about acquiring skills and insights to solve problems."

For children in the later elementary grades, the site suggests an Internet Mathematics Excursion such as Accessing and Investigating Data Using the World Wide Web: Part 1 National Population Projections. This detailed lesson is tied directly to standards, and includes links to Web sites, handouts, and data to support the lesson.

#### Grades 6-8

At the middle school level, NCTM's Principles and Standards for School Mathematics proposes an ambitious and rich experience that both prepares students to use math effectively in their lives outside school and lays a solid foundation for the study of math in high school. "Students are expected to learn serious, substantive mathematics in classrooms in which the emphasis is on thoughtful engagement and meaningful learning"

The NCTM Web site also provides links to selected Web resources such as the Copernicus Education Gateway's Women in the Olympic Arena lesson. Another NCTM link, Figure This! Math Challenges for Families, offers a large number of challenges students and other family members can work on together.

#### Grades 9-12

For high school students, NCTM standards state, "In grades 9-12, students should encounter new classes of functions, new geometric perspectives, and new ways of analyzing data. They should begin to understand aspects of mathematical form and structure, such as that all quadratic functions

share certain properties, as do all functions of other classes -- linear, periodic, or exponential. Students should see the interplay of algebra, geometry, statistics, probability, and discrete mathematics and various ways that mathematical phenomena can be represented. Through their high school experiences, they stand to develop deeper understandings of the fundamental mathematical concepts of function and relation, invariance, and transformation."

A lesson plan titled Interpreting the "Real-Life" Meaning of Graphical Representations of Data" addresses algebra and data analysis and probability standards through eight lessons.

## Science

Since technology is always tied with curriculum, the first step for integrating technology into science classes is to look at the standards. Once it's clear what we want students to know and be able to do, we can look at ways technology tools might enhance their experience. The rest of this section refers to work done at the national level. If you correlate these ideas with your state and local standards, you will see how the resources suggested here can support classroom work.

Produced in 1995 by The National Research Council, the National Science Education Standards is a document that outlines science education. However, the National Science Teachers Association (NSTA) is quick to point out that the Standards does not present a curriculum or a set of lesson plans, it offers "goals for achievement that are appropriate for all members of the science education community." The document talks about six aspects of science education:

- ♦ Standards for science teaching
- ♦ Standards for professional development for teachers of science
- ♦ Standards for assessment in science education
- ♦ Standards for science content
- ♦ Standards for science education programs

- ♦ Standards for science education systems

How do you integrate technology into your science curriculum? Many Web sites can help you begin. Here are just a few:

**1. NSTA:** The organization provides resources including links to activities that combine classroom and online sharing of data and other information. Here are some highlights:

- ♦ **Astronomy with a Stick:** This lesson engages students in units that familiarize them with tracking shadows, observing and quantifying the change in daylight hours, and creating models of the Earth's latitude-longitude grid.
- ♦ **Galapagos Education Site:** A collaboration between NSTA and the Smithsonian Institution, this site comes complete with links to a Galapagos Guide, classroom investigations, and resources for teaching evolution.
- ♦ **The 1999 Toshiba/NSTA Laptop Learning Challenge:** This site includes several lesson plans for K-12 students, including the following high school lessons: Controlling Robots, Community Cartography, Aquatic Field Data, Mapping by Satellite, and Amusement Park Physics, which can be downloaded as PDF files.
- ♦ **Forensics in the Classroom:** For middle and high school students, NSTA has teamed up with Court TV to produce forensics lessons that cover a number of standards. After signing up for the free lessons, teachers and students have access to the detailed plans, along with links to resources to further their study. Each lesson presents an intriguing challenge or problem, and students then learn about specific steps they can take to solve the mystery. For example, in The Cafeteria Caper, students will conduct an enzyme test as well as test hair and blood for DNA to figure out who trashed the cafeteria.

**2. The National Educational Technology Standards for Students (NETS):** On this Web site you will find the table of contents from ISTE publication NETS for Teachers:

Preparing Teachers to Use Technology, which has lessons for grades K-12 that integrate technology into the curriculum. The lessons can be downloaded as PDF files or viewed on the Web. The science lessons you will find include:

### Grades PreK-2

- ♦ Classifying Animals
- ♦ Home Sweet Home

### Grades 3-5

- ♦ Who's Who in Fingerprinting
- ♦ World Wide Weather

### Grades 6-8

- ♦ Bird Rap -- A Web Guide to Local Birds
- ♦ Earth Movement in Real Time

### Grades 9-12

- ♦ Acceleration
- ♦ How Big Are We?

**3. The Nature of Water Power:** The Nature of Water Power is a thematic science unit appropriate for Grades 6 through 8. It lists the Standards Alignments for the states of Idaho, Montana, Oregon, and Washington.

**4. The Science Education Gateway:** This site belongs to a national consortium of scientists, museums, and educators working together to bring the latest science to students, teachers, and the general public. The Lesson List lets you "Go To" a lesson such as Auroras: Paintings in the Sky or Martian Sun-Times.

The following Web sites appear on this page:

#### Math

##### Grades PreK-2:

[standards.nctm.org/document/chapter4/index.htm](http://standards.nctm.org/document/chapter4/index.htm)

##### National Council of Teachers of Mathematics:

[www.nctm.org/](http://www.nctm.org/)

##### Spoonytunes:

[www.nctm.org/elementary/archive.asp](http://www.nctm.org/elementary/archive.asp)

##### Grades 3-5:

[standards.nctm.org/document/chapter5/index.htm](http://standards.nctm.org/document/chapter5/index.htm)

##### Accessing and Investigating Data Using the World Wide Web: Part 1 National Population Projections:

[illuminations.nctm.org/lessonplans/3-5/data1/index.html](http://illuminations.nctm.org/lessonplans/3-5/data1/index.html)

##### Grades 6-8:

[standards.nctm.org/document/chapter6/index.htm](http://standards.nctm.org/document/chapter6/index.htm)

##### Women in the Olympic Arena:

[illuminations.nctm.org/swr/review.asp?SWR=195](http://illuminations.nctm.org/swr/review.asp?SWR=195)

##### Figure This! Math Challenges for Families:

[www.figurethis.org/](http://www.figurethis.org/)

##### Grades 9-12:

[standards.nctm.org/document/chapter7/index.htm](http://standards.nctm.org/document/chapter7/index.htm)

##### Interpreting the "Real Life" Meaning of Graphical Representations of Data:

[illuminations.nctm.org/lessonplans/9-12/real\\_life/index.html](http://illuminations.nctm.org/lessonplans/9-12/real_life/index.html)

#### Science

##### National Science Education Standards:

[www.nsta.org/standards](http://www.nsta.org/standards)

**NSTA:** [www.nsta.org/](http://www.nsta.org/)

**Astronomy with a Stick:** [www.nsta.org/awscopy](http://www.nsta.org/awscopy)

##### Galapagos Education Site:

[pubs.nsta.org/galapagos/](http://pubs.nsta.org/galapagos/)

##### The 1999 Toshiba/NSTA Laptop Learning Challenge:

[www.nsta.org/programs/laptop/grade.htm](http://www.nsta.org/programs/laptop/grade.htm)

##### Forensics in the Classroom:

[www.courtvtv.com/forensics\\_curriculum/](http://www.courtvtv.com/forensics_curriculum/)

##### The National Educational Technology Standards for Students:

[cnets.iste.org/](http://cnets.iste.org/)

##### Classifying Animals:

[cnets.iste.org/students/pf/pf\\_classifying\\_animals.html](http://cnets.iste.org/students/pf/pf_classifying_animals.html)

**Home Sweet Home:**

[cnets.iste.org/students/pf/pf\\_home\\_sweet\\_home.html](http://cnets.iste.org/students/pf/pf_home_sweet_home.html)

**Who's Who in Fingerprinting:**

[cnets.iste.org/students/pf/pf\\_whos\\_who.html](http://cnets.iste.org/students/pf/pf_whos_who.html)

**World Wide Weather:**

[cnets.iste.org/students/pf/pf\\_world\\_wideweather.html](http://cnets.iste.org/students/pf/pf_world_wideweather.html)

**Bird Rap -- A Web Guide to Local Birds:**

[cnets.iste.org/students/pf/pf\\_bird\\_rap.html](http://cnets.iste.org/students/pf/pf_bird_rap.html)

**Earth Movement in Real Time:**

[cnets.iste.org/students/pf/pf\\_earth\\_movement.html](http://cnets.iste.org/students/pf/pf_earth_movement.html)

**Acceleration:**

[cnets.iste.org/students/pf/pf\\_acceleration.html](http://cnets.iste.org/students/pf/pf_acceleration.html)

**How Big Are We:**

[cnets.iste.org/students/pf/pf\\_how\\_big.html](http://cnets.iste.org/students/pf/pf_how_big.html)

**The Nature of Water Power:**

[www.fwee.org/TG/nwaterpwr.html](http://www.fwee.org/TG/nwaterpwr.html)

**The Science Education Gateway:**

[cse.ssl.berkeley.edu/SegwayEd/index.html](http://cse.ssl.berkeley.edu/SegwayEd/index.html)

**Auroras: Paintings in the Sky:**

[cse.ssl.berkeley.edu/SegwayEd/abtauror.html](http://cse.ssl.berkeley.edu/SegwayEd/abtauror.html)

**Martian Sun-Times:**

[cse.ssl.berkeley.edu/SegwayEd/abtmarst.html](http://cse.ssl.berkeley.edu/SegwayEd/abtmarst.html)

## Integrating Technology into Math and Science Resources

### Math

#### PowerPoint® Presentation

##### Content:

This PowerPoint presentation introduces technology integration. It discusses the importance of technology integration, changes in teacher/student roles, and what components are needed for technology integration.

The presentation includes examples of classrooms integrating technology. It then asks for group participation.

##### Description:

1. The PowerPoint presentation consists of 13 slides. You can see this PowerPoint presentation online in your browser.

2. If you have Microsoft PowerPoint, you can download the PowerPoint file so you can actually show it as a PowerPoint presentation from your own computer in the classroom. If you download this PowerPoint file, you can make changes, insert your own course information, and use it as you would ANY PowerPoint.

**Speaker Notes:** Each slide in the downloaded and online versions contains Speaker Notes which you can use in class as lecture notes when you show the PowerPoint presentation.

3. If you do not have Microsoft PowerPoint, you can download PowerPoint Viewer® (Windows) or PowerPoint Viewer (Mac), which will allow you to share this presentation with an audience, but will not allow you to edit it in any way.

##### Uses:

1. You can use the html version, online, during class time if you have a computer and presentation system that has Internet access. Use it as you would any lecture presentation material.

2. You can download the PowerPoint file to your hard drive or CD-ROM for use on your laptop or classroom computer. You open and

run the PowerPoint file just as you would any other PowerPoint presentation.

#### Activities

##### Activities -- Part 1

*These activities introduce the participants to numerous educational Web sites that promote Internet use with all grade levels. It is not the intent to promote any particular Web site but rather to introduce ideas about how to integrate mathematics and technology into the classroom. In Activities -- Part 1, participants will explore Web sites that offer math challenges or particular math lessons, so that participants can get some idea of the range of sites that exist on the Web for engaging students in thinking about and applying math. If there is time, participants should be encouraged to research the Internet for other sites that address math topics and interests not expressed here and share those sites as well.*

##### 1. Explore and Discuss

Ask participants to form groups of two or three. Have them visit at least three of the following Web sites. (This first set of sites includes projects and activities that are already set up for immediate participation. The second set of sites includes destinations where a large number of links are collected from which teachers select and shape activities that address the curriculum goals for their own students.) Tell the participants to reflect on the following questions as they explore the individual sites.

- ♦ Do you think these sites would engage your students? Why?
- ♦ Which site(s) could you use with your students? How?
- ♦ Did these sites make you want to find more like them? Why?

**National Math Trail:** Students develop math questions that address specifics in their own

communities and submit them to the online collection. See more details at its Apple Learning Interchange Exhibit.

**FIRST Robotics Competition:** High school students address an engineering challenge by building and programming a robot. This competition costs money to enter, but grant possibilities are provided.

**FIRST LEGO League (Junior Robotics):** Students build a robot to perform tasks on a given playing field. In 2003, the challenge was given to visit Mars and explore the planet with an idea of colonizing it.

**ThinkQuest: Library of math sites:** Browse the library of math entries into the ThinkQuest contest to see what topics and particular entries your students will find intriguing.

**Global SchoolNet Foundation: Dos Gotas de Aqua (Two Drops of Water):** In this project, middle and high school students in Patagonia, Concepcion, and Easter Island, Chile, explore local freshwater and marine ecosystems, and share what they have found. Other classes are invited to join the project.

**Blue Web'n Math:** Browse this site's collection of math activities to see what would appeal to you and your students.

**ALI: NASA Connect: The "Wright" Math:** Students will learn about the evolution of flight through hands-on and Web activities in this project that is co-sponsored by NASA.

**ALI: Quilting and Geometry: Patterns for Living:** In this example of practical application of geometry and problem solving, teacher Jean Kriwox provides a detailed lesson, along with standards alignment, assessment, student work, reflections, resources, and more.

**Eric Weisstein's World of Mathematics:** At this site, touted as "the Web's most complete mathematical resource," teachers and students will find a myriad of information on a large number of math topics, complete with diagrams, explanations, and links. See also Eric Weisstein's World of Physics.

**National Library of Virtual Manipulatives for Interactive Mathematics:** This comprehensive site presents online challenges for pre-K through high school students, using virtual manipulatives such as an abacus, geoboard, or attribute blocks to address topics in numbers and operations, algebra, geometry, measurement, and data analysis and probability. Information is provided for teachers and parents, and alignment to standards is given.

**Plane Math:** At this site, students perform online activities that teach concepts of math and aeronautics.

**The Mint:** With the intent of acquainting students with the importance of thinking about money management and the choices they make, this site provides lessons for teachers, hints for parents, and a lot of ideas for kids on topics such as spending, saving, earning, investing, and keeping track of what you have.

**Math and music: Teaching Math with Music:** This 1998 publication lays out the solid arguments for incorporating math and music, and includes some activity ideas, along with standards alignment information. A simple demonstration of rhythm can be found in Build Your Own.

**Prime Number Listening Guide:** At this page, a researcher at the University of Tennessee-Martin, provides an opportunity for students to "hear" prime numbers.

## 2. Record and Share

Have the individual participants choose a lesson or activity from one of the above sites. Ask them: "What made this lesson or activity one you would use with your students? What would you need to do to use this lesson or activity in your class? How would you prepare your students before you sent them to this site?"

- ♦ Have the individuals record their ideas.
- ♦ Have the individuals share with the large group.
- ♦ Have the group speculate on additional activities that might be generated from the lesson or activity.

- ◆ Have the group discuss how different grade levels could use the sites.

### 3. Reflect

Ask participants to reflect upon what they saw and discussed. Have the participants journal their reflections. They might want to include answers to the following questions:

- ◆ What standards would be addressed by your students using these sites?
- ◆ What specific curriculum topics would be enhanced by student participation in these projects or activities?
- ◆ What sort of assessment would be appropriate to measure student understanding?
- ◆ What timeline makes sense (i.e., what needs to be done to prepare students for online participation and when should it take place; how much time will participation take; when will this project fit into the school year)?
- ◆ What do you need to make this participation successful for you and your students (e.g., contact with experts; a field trip; print and online resources)?
- ◆ What do you need to know or do to make this a successful experience for you and your students?

Ask for volunteers to share their thoughts.

### Activities -- Part 2

*These activities engage participants in exploring sites developed for educators that include links to curriculum and grade-specific lessons and other resources. We often call these "portal" sites because they provide links to many other sites on the Web. All of the sites contain lesson plans on math topics, as well as other resources for educators. The intent of this activity is to familiarize participants with these portals and what they contain in a setting where participants review a limited number of sites, and share their findings with colleagues. You may want to have participants fill out site review forms and share them with*

*each other, so that all participants have copies of review for all sites listed.*

### 1. Explore and Discuss

Ask participants to form groups of two or three. Have the group select three sites they would like to visit. Have each group member visit one site, taking extensive notes on what is available for elementary, middle, and high school classes. Have participants reflect on the following questions as they explore the individual sites.

- ◆ What are the interesting features of this site?
- ◆ What are a few examples of the kinds of lessons found at this site?
- ◆ Would you recommend this site to a colleague? Why?

**Global SchoolNet Foundation:** At this Project Registry page, a simple or advanced search will get you to a number of projects that are available for class participation. You can also submit one of your own that invites other teachers and classes to join your class.

**PBS Teacher Source:** At this page, select a grade range and math topic to search the database for lesson plans and activities.

**WebQuests:** Designed by Dr. Bernie Dodge, WebQuests engage students in learning through identifying, exploring, and analyzing information on a topic found on the Internet. At the WebQuest Portal, teachers can click on Top, Middling, or New in the left margin of this page to get to matrices of WebQuests, organized by grade level and curriculum area.

**Blue Web'n:** Sponsored by SBC, this site contains links to more than 1,800 learning sites, and is searchable by content area, subject area, and grade level.

**ThinkQuest Library:** This site hosts a library of entries in the ThinkQuest Internet Challenge and the ThinkQuest Junior contest, in which students create Web sites in content areas for the purpose of teaching other students.

Browsing the math area will yield a number of sites that will engage students in learning math concepts.

**Kathy Schrock's Guide for Educators:** This site reveals a rich resource created and maintained by a library media director. By visiting the Lesson Plans Library, you can search for lessons by subject and grade level.

**Education World Math Center:** At this site, users can access a variety of resources, including articles about math topics, lessons, and links to other math sites. An archive of lessons developed by teachers can also be found.

**Eisenhower National Clearinghouse for Math and Science Education:** This site features information, lessons, curriculum resources, and more.

**Project SkyMath: Making Mathematical Connections:** Designed for middle school math teachers, this site presents information about and access to NASA's SkyMath activities.

**Ohio Resource Center for Mathematics, Science, and Reading:** At this site, educators will find a wealth of resources. While geared to Ohio educators, math lessons (searchable by grade and topic) from around the world are categorized and linked from this site.

**Ask Dr. Math:** At this Web site, teachers can pose questions to experts to help them demonstrate, explain, or pose challenges to their students on mathematical topics.

## 2. Record and Share

Have the individual participants choose a lesson or activity from one of the above sites. Ask them: "What made this lesson or activity one you would use with your students? What would you need to do to use this lesson or activity in your class? How would you prepare your students before you sent them to this site?"

- ◆ Have the individuals record their ideas.
- ◆ Have the individuals share with the large group.

- ◆ Have the group speculate on additional activities that might be generated from the lesson or activity.
- ◆ Have the group discuss how different grade levels could use the sites.

## 3. Reflect

Ask participants to reflect upon what they saw and discussed. Have the participants journal their reflections. Ask volunteers to share their thoughts.

## Suggested Readings

### GLEF Articles and Videos:

- ◆ Geometry in the Real World: Students as Architects and accompanying video segment "Mountlake Terrace High School"
- ◆ Building a Better Robot and accompanying video segment "Poudre High School Robotics"
- ◆ Laptops for All and accompanying video segment "Mott Hall"
- ◆ Handhelds Go to Class and accompanying video segment "Handhelds"
- ◆ Laptops on Expedition and accompanying video segment "A Product of Learning"
- ◆ More Fun Than a Barrel of ... Worms?! and accompanying video segment "Newsome Park"
- ◆ A Change in Attitude and accompanying video segment "Harrison Central High School"
- ◆ From Brain-Based Research to Powerful Learning and accompanying video segment "Key Largo School"
- ◆ MarcoPolo: Showing Teachers How to Use Rich Internet Content in Their Classrooms
- ◆ A Sampler of International Web Projects

### External Links:

- ◆ Apple Learning Interchange

- ♦ International Society for Technology in Education
- ♦ Kathy Schrock's Guide for Educators
- ♦ Thursday's Classroom
- ♦ Cyberbee Curriculum Ideas
- ♦ Teachers' First Content Matrix
- ♦ Intel Innovation in Education
- ♦ Landmarks for Schools
- ♦ Marco Polo
- ♦ Blue Web'n
- ♦ The Exploratorium
- ♦ WestEd Eisenhower Regional Consortium
- ♦ WestEd
- ♦ National Center for Education Statistics
- ♦ National Center for Education Statistics: TIMSS Study

**Recommended Texts:**

***Edutopia: Success Stories for Learning in the Digital Age***

The George Lucas Educational Foundation  
 Published: May 2002 by Jossey-Bass, A Wiley Company  
 Copyright © 2002  
 ISBN: 0-7879-6082-9

***Literacy in the Information Age: Inquiries into Meaning Making with New Technologies***

Bertram C. Bruce, Editor  
 Published: 2003 by the International Reading Association, Inc.  
 Copyright © 2003  
 ISBN: 0-87207-003-4

***Connecting Mathematics and Science to Workplace Contexts: A Guide to Curriculum Materials***

Edward Britton, Mary Ann Huntley, Gloria

Jacobs, and Amy Shulman Weinberg  
 Published: 1999 by Corwin Press, Inc.  
 Copyright © 1999  
 ISBN: 0-8039-6867-1 (paperback)  
 ISBN: 0-8039-6866-3 (hardcover)

***Family Math II: Achieving Success in Mathematics***

Grace Davila Coates and Virginia Thompson  
 Published: February, 2003 by EQUALS  
 Copyright © 2003  
 ISBN: 0-9125-1130-3

***Spark Your Child's Success in Math and Science: Practical Advice for Parents***

Jacqueline Barber, Nicole Parizeau, Lincoln Bergman, and Patricia Lima (Illustrator)  
 Published: July, 2002 by GEMS Project  
 Copyright © 2002  
 ISBN: 0-9248-8671-4

***Changing the Faces of Mathematics: Perspectives on Indigenous People in North America***

Walter Secada  
 Published: National Council of Teachers of Mathematics  
 Copyright © 2002

***Inspired by Standards: Math Teachers in Their Classrooms (CD-ROM)***

Shelley Goldman, producer  
 Published: 2001 by WestEd  
 Copyright © 2001

**Science**

**PowerPoint® Presentation**

**Content:**

This PowerPoint presentation introduces technology integration. It discusses the importance of science and technology integration, what components are needed for science and technology integration, and how science and technology integration might occur.

The presentation includes examples of classrooms integrating science and technology. It then asks for group participation.

## Description:

1. The PowerPoint presentation consists of 13 slides. You can see this PowerPoint presentation online in your browser.

2. If you have Microsoft PowerPoint, you can download the PowerPoint file so you can actually show it as a PowerPoint presentation from your own computer in the classroom. If you download this PowerPoint file, you can make changes, insert your own course information, and use it as you would ANY PowerPoint.

**Speaker Notes:** Each slide in the downloaded and online versions contains Speaker Notes which you can use in class as lecture notes when you show the PowerPoint presentation.

3. If you do not have Microsoft PowerPoint, you can download PowerPoint Viewer (Windows) or PowerPoint Viewer (Mac), which will allow you to share this presentation with an audience, but will not allow you to edit it in any way.

## Uses:

1. You can use the html version, online, during class time if you have a computer and presentation system that has Internet access. Use it as you would any lecture presentation material.

2. You can download the PowerPoint file to your hard drive or CD-ROM for use on your laptop or classroom computer. You open and run the PowerPoint file just as you would any other PowerPoint presentation.

## Activities

### Activities -- Part 1

*These activities introduce the participants to numerous educational Web sites that promote Internet use with all grade levels. It is not the intent to promote any particular Web site, but rather to introduce ideas about how to integrate science and technology into the classroom. In Activities -- Part 1, participants will explore Web sites that offer science challenges or particular science lessons, so that participants can get some idea of the*

*range of sites that exist on the Web for engaging students in thinking about and applying science. If there is time, participants should be encouraged to research the Internet for other sites that address science topics and interests not expressed here and share those sites as well.*

### 1. Explore and Discuss

Ask participants to form groups of two or three. Have them visit at least three of the following Web sites. (This first set of sites includes projects and activities that are already set up for immediate participation. The second set of sites includes destinations where a large number of links are collected from which teachers select and shape activities that address the curriculum goals for their own students.) Tell the participants to reflect on the following questions as they explore the individual sites.

- ♦ Do you think these sites would engage your students? Why?
- ♦ Which site(s) could you use with your students? How?
- ♦ Did these sites make you want to find more like them? Why?

**Journey North: A Global Study of Wildlife Migration:** At this site, students and teachers can find out information about the yearly migration of such creatures as monarch butterflies, gray whales, whooping cranes, hummingbirds, and caribou. Classes can join others in tracking these creatures in their northern migration in the spring and their southern migration in the fall.

**JASON Project:** The JASON Project engages students in projects conducted by scientists. A team of students actually accompanies the scientists, while classrooms across the country and beyond track their progress, suggest experiments, and share information.

**Operation Ruby-Throat Operation Ruby-Throat:** The Humming Bird Project is an initiative of Hilton Pond Center for Piedmont Natural History in York, South Carolina.

According to the Web site, this unique project uses the Ruby-throated Hummingbird (*Archilochus colubris*) as a focal point for integrated studies of meteorology, environmental science, animal behavior, botany, and the physical sciences -- as well as math, language arts, geography, and other disciplines -- all aided by modern telecommunications and computer technology.

**Bugscope:** This project provides students with remote access to scanning electron microscope in order to see insects at high magnification. Resources and links to other electron microscopy sites are provided.

**Neuroscience for Kids:** This site teaches about the brain, provides links to activities and experiments, and references a great many resources. Take a look at the accompanying Brain Alphabet Web site.

**Mail-an-Egg:** his lesson plan, from Tracy Trimpe's Science Spot site, challenges students to build a container in which they can mail a raw egg through the postal system.

**Build a Toothpick Bridge:** At this Web site, students are challenged to a competition to design and build a bridge that will hold the greatest load out of toothpicks.

**How Tattoos Work:** At the How Stuff Works site, there are a number of examples, with detailed information available for students to use in exploring a topic. Included in the How Tattoos Work site is information on the history of tattoos, early tattooing methods, the tattooing machine, pain, safe tattooing, and more.

**The Hubble Telescope and Tracking Hubble:** After reviewing these Hubble Telescope sites, which contain a wealth of information on the Hubble Telescope Project, you may want your students to make their own. See the Hand-held Hubble site for specific instructions in making a model for under \$20.

**National Library of Virtual Manipulatives for Interactive Mathematics:** This comprehensive site presents online challenges for pre-K through high school students, using virtual manipulatives such as an abacus,

geoboard, or attribute blocks to address topics in numbers and operations, algebra, geometry, measurement, and data analysis and probability. Information is provided for teachers and parents, and alignment to standards is given.

**ThinkQuest Library of science sites:** Browse the library of science entries into the ThinkQuest contest to see what topics and particular entries your students will find intriguing.

**Global SchoolNet Foundation: TESAN (the endangered species and nature):** Students in classrooms from around the world are invited to participate in this project to learn about and appreciate endangered species.

**Global SchoolNet Foundation: Woodland Network:** This project invites 1st-grade through 12th-grade students from around the world to participate in three interactive projects (A Day in a Woodland, Just a Tree, and Research) through which they collect, interpret, and share data on woodland areas.

**Blue Web'n Science:** Browse this site's collection of science activities to see what would appeal to you and your students.

**ALI: NASA Connect: Festival of Flight Special: Opening Space for Next Generation Explorers:** In this Virtual Field Trip, students will "apply their problem-solving skills by using statistical data and mathematical modeling to determine the optimum propellant ratio for best vehicle performance of a chemical reaction rocket (CR2)."

**ALI: Incorporating Technology into the Scientific Method:** Developed by high school science teacher Susie Stevens, students will engage in developing scientific investigations which include analyzing data, creating and interpreting graphs, and communicating their findings.

**Space Day:** Students in grades 4 through 8 participate in design challenges that provide opportunities for collaboration while solving problems that challenge real-life space scientists.

## 2. Record and Share

Have the individual participants choose a lesson or activity from one of the above sites. Ask

them: "What made this lesson or activity one you would use with your students? What would you need to do to use this lesson or activity in your class? How would you prepare your students before you sent them to this site?"

- ♦ Have the individuals record their ideas.
- ♦ Have the individuals share with the large group.
- ♦ Have the group speculate on additional activities that might be generated from the lesson or activity.
- ♦ Have the group discuss how different grade levels could use the sites.

### 3. Reflect

Ask participants to reflect upon what they saw and discussed. Have the participants journal their reflections. They might want to include answers to the following questions:

- ♦ What standards would be addressed by your students using these sites?
- ♦ What specific curriculum topics would be enhanced by student participation in these projects or activities?
- ♦ What sort of assessment would be appropriate to measure student understanding?
- ♦ What timeline makes sense (i.e., what needs to be done to prepare students for online participation and when should it take place; how much time will participation take; when will this project fit into the school year)?
- ♦ What do you need to make this participation successful for you and your students (e.g., contact with experts; a field trip; print and online resources)?
- ♦ What do you need to know or do to make this a successful experience for you and your students?

Ask for volunteers to share their thoughts.

## Activities -- Part 2

*These activities engage participants in exploring sites developed for educators that include links to curriculum and grade-specific lessons and other resources. We often call these "portal" sites because they provide links to many other sites on the Web. All of the sites contain lesson plans on science topics, as well as other resources for educators. The intent of this activity is to familiarize participants with these portals and what they contain in a setting where participants review a limited number of sites, and share their findings with colleagues. You may want to have participants fill out site review forms and share them with each other, so that all participants have copies of review for all sites listed.*

### 1. Explore and Discuss

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- ♦ What are the interesting features of this site?
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- ♦ Would you recommend this site to a colleague? Why?

**Global SchoolNet Foundation:** At this Project Registry page, a simple or advanced search will get you to a number of projects that are available for class participation. You can also submit one of your own that invites other teachers and classes to join your class.

**PBS Teacher Source:** At this page, select a grade range and science topic to search the database for lesson plans and activities.

**Changing the Face of Medicine:** This site includes lessons for K-2, 3-4, 5-8, and 9-12, as well as some interactive online activities using Flash.

**WebQuests:** Designed by Dr. Bernie Dodge, WebQuests engage students in learning through identifying, exploring, and analyzing information on a topic found on the Internet. At the WebQuest Portal, teachers can click on Top, Middling, or New in the left margin of this page to get to matrices of WebQuests, organized by grade level and curriculum area.

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**Education World Science Center:** At this site, users can access a variety of resources, including lessons and other science sites.

**Ohio Resource Center for Mathematics, Science, and Reading:** At this site, educators will find a wealth of resources. While geared to Ohio educators, science lessons (searchable by grade and topic) from around the world are categorized and linked from this site.

**The Science Spot:** Illinois educator Mrs. Tracy Trimpe has created a wonderful science resource, including links to lessons, projects, puzzles, daily science trivia ideas, a reference section, and a section called The Idea Factory where teachers share teaching tips.

**Ology:** Developed by the American Museum of Natural History, this site provides information on a variety of science topics, including biodiversity, astronomy, archaeology, genetics, and paleontology.

**Pitsco Innovative Education:** At this site, you will find 32 examples of science competitions, including weather prediction, paper airplanes, egg drop vehicles, and e-circuits.

**Pitsco's Ask an Expert:** At this site, students can submit e-mail questions to experts in hundreds of fields. Science and technology experts include a geologist, a forensic scientist, a plasma physicist, a solar car expert, a volcano expert, and a terrarium guru.

**How Stuff Works:** At this site, information on how stuff works abounds, including computers, electronics, autos, science, home, entertainment, money, health, travel, and people stuff.

## 2. Record and Share

Have the individual participants choose a lesson or activity from one of the sites. Ask them: "What made this lesson or activity one you would use with your students? What would you need to do to use this lesson or activity in your class? How would you prepare your students before you sent them to this site?"

- ♦ Have the individuals record their ideas.
- ♦ Have the individuals share with the large group.
- ♦ Have the group speculate on additional activities that might be generated from the lesson or activity.
- ♦ Have the group discuss how different grade levels could use the sites.

## 3. Reflect

Ask participants to reflect upon what they saw and discussed. Have the participants journal their reflections. Ask volunteers to share their thoughts.

## Suggested Readings

### GLEF Articles and Videos:

- ♦ Laptops on Expedition and accompanying video segment "A Product of Learning"

- ♦ The Maine Event and accompanying video segment "Leading with Laptops"
- ♦ It's All Happening at the Zoo School and accompanying video segment "School of Environmental Studies"
- ♦ Handhelds Go to Class and accompanying video segment "Handhelds"
- ♦ Biotech Academy: Challenging Assumptions and Changing Lives and accompanying video segment "Biotech Academy: A Catalyst for Change"
- ♦ Building a Better Robot and accompanying video segment "Poudre High School Robotics"
- ♦ More Fun Than a Barrel of ... Worms?! and accompanying video segment "Newsome Park"
- ♦ JASON and the New Argonauts and accompanying video segment "JASON Project"
- ♦ Connecting with Experts in the Real World
- ♦ March of the Monarchs and accompanying video segment "Journey North"
- ♦ Classrooms Without Boundaries and accompanying video segment "West Hawaii Explorations Academy"
- ♦ Space Age Thinkers and accompanying video segment "Space Day"
- ♦ Bugscope: Magnifying the Connection Between Students, Science, and Scientists
- ♦ MarcoPolo: Showing Teachers How to Use Rich Internet Content in Their Classrooms
- ♦ Latinas en Ciencia: Making Science and Technology Real for Girls
- ♦ A Sampler of International Web Projects
- ♦ International Society for Technology in Education
- ♦ Kathy Schrock's Guide for Educators
- ♦ Thursday's Classroom
- ♦ Teachers' First Content Matrix
- ♦ Intel Innovation in Education
- ♦ Landmarks for Schools
- ♦ Marco Polo
- ♦ Blue Web'n
- ♦ Science Resources
- ♦ The Exploratorium
- ♦ WestEd Eisenhower Regional Consortium
- ♦ WestEd
- ♦ National Center for Education Statistics
- ♦ National Center for Education Statistics: TIMSS Study

**Recommended Texts:**

***Edutopia: Success Stories for Learning in the Digital Age***

The George Lucas Educational Foundation  
 Published: May 2002 by Jossey-Bass, A Wiley Company  
 Copyright © 2002  
 ISBN: 0-7879-6082-9

***Literacy in the Information Age: Inquiries into Meaning Making with New Technologies***

Bertram C. Bruce, Editor  
 Published: 2003 by the International Reading Association, Inc.  
 Copyright © 2003  
 ISBN: 0-87207-003-4

***Connecting Mathematics and Science to Workplace Contexts: A Guide to Curriculum Materials***

Edward Britton, Mary Ann Huntley, Gloria Jacobs, and Amy Shulman Weinberg

**External Links:**

- ♦ Apple Learning Interchange
- ♦ GLEF Learning Interchange

Published: 1999 by Corwin Press, Inc.  
Copyright © 1999  
ISBN: 0-8039-6867-1 (paperback)  
ISBN: 0-8039-6866-3 (hardcover)

***Square Wheels and Other Easy-to-Build Hands-On Science Activities***

Don Rathjen, Peter Doherty, The Exploratorium Teacher Institute, and Esther Kutnick (Illustrator)  
Published: April 2002 by Exploratorium Store  
Copyright © 2002  
ISBN: 0-9434-5155-8

***Spark Your Child's Success in Math and Science: Practical Advice for Parents***

Jacqueline Barber, Nicole Parizeau, Lincoln Bergman, and Patricia Lima (Illustrator)  
Published: July, 2002 by GEMS Project  
Copyright © 2002  
ISBN: 0-9248-8671-4

***Weaving Science Inquiry and Continuous Assessment: Using Formative Assessment to Improve Learning***

Maura O'Brien Carlson, Gregg E. Humphrey, Karen S. Reinhardt  
Published: April 2003 by Corwin Press  
Copyright © 2003  
ISBN: 0-7619-4590-3

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The following Web sites appear on this page:

**Math**

**PowerPoint presentation (online):**

[www.glef.org/modules/ms/Math\\_PPT/ppframe.htm](http://www.glef.org/modules/ms/Math_PPT/ppframe.htm)

**PowerPoint presentation (download):**

[www.glef.org/modules/ms/Math.ppt](http://www.glef.org/modules/ms/Math.ppt)

**PowerPoint Viewer (Windows):**

[office.microsoft.com/OfficeUpdate/default.aspx?displaylang=EN](http://office.microsoft.com/OfficeUpdate/default.aspx?displaylang=EN)

**PowerPoint Viewer (Mac):**

[www.microsoft.com/mac/downloads.aspx?pid=download&location=/mac/download/office98/powerpoint98viewer.xml&secid=20&ssid=7&flgnosysreq=False](http://www.microsoft.com/mac/downloads.aspx?pid=download&location=/mac/download/office98/powerpoint98viewer.xml&secid=20&ssid=7&flgnosysreq=False)

**National Math Trail:** [www.nationalmathtrail.org](http://www.nationalmathtrail.org)

**National Math Trail's Apple Learning Interchange Exhibit:**

[ali.apple.com/ali\\_sites/ali/exhibits/1000004/](http://ali.apple.com/ali_sites/ali/exhibits/1000004/)

**FIRST Robotics Competition:**

[www.usfirst.org/robotics/](http://www.usfirst.org/robotics/)

**FIRST LEGO League (Junior Robotics):**

[www.usfirst.org/jrobtcs/index.html](http://www.usfirst.org/jrobtcs/index.html)

**ThinkQuest: Library of math sites:**

[www.thinkquest.org/library/cat\\_show.html?cat\\_id=9](http://www.thinkquest.org/library/cat_show.html?cat_id=9)

**Global SchoolNet Foundation: Dos Gotas de Agua (Two Drops of Water):**

[www.gsn.org/pr/\\_cfm/GetDetail.cfm?Startrow=11&pID=954&CurrFit=ma&sortby=ORDER%20BY%20pStartDate](http://www.gsn.org/pr/_cfm/GetDetail.cfm?Startrow=11&pID=954&CurrFit=ma&sortby=ORDER%20BY%20pStartDate)

**Blue Web'n Math:**

[www.kn.pacbell.com/wired/bluwebn/contentarea.cfm?cid=9](http://www.kn.pacbell.com/wired/bluwebn/contentarea.cfm?cid=9)

**ALI: NASA Connect: The "Wright" Math:**

[ali.apple.com/ali\\_sites/ali/exhibits/1000853/](http://ali.apple.com/ali_sites/ali/exhibits/1000853/)

**ALI: Quilting and Geometry-Patterns for Living:**

[ali.apple.com/ali\\_sites/ali/exhibits/1000077/](http://ali.apple.com/ali_sites/ali/exhibits/1000077/)

**Eric Weisstein's World of Mathematics:**

[mathworld.wolfram.com/](http://mathworld.wolfram.com/)

**Eric Weisstein's World of Physics:**

[scienceworld.wolfram.com/physics/](http://scienceworld.wolfram.com/physics/)

**National Library of Virtual Manipulatives for Interactive Mathematics:**

[matti.usu.edu/nlvm/nav/vlibrary.html](http://matti.usu.edu/nlvm/nav/vlibrary.html)

**Plane Math:** [www.planemath.com/](http://www.planemath.com/)

**The Mint:** [themint.org/](http://themint.org/)

**Math and music: Teaching Math with Music:**

[www.sedl.org/scimath/compass/v04n02/welcome.html](http://www.sedl.org/scimath/compass/v04n02/welcome.html)

**Build Your Own:**

[www.sedl.org/scimath/compass/v04n02/flash/activity.html](http://www.sedl.org/scimath/compass/v04n02/flash/activity.html)

**Prime Number Listening Guide:**

[www.utm.edu/research/primes/programs/music/listen](http://www.utm.edu/research/primes/programs/music/listen)

**Global SchoolNet Foundation:**

[www.gsn.org/pr/\\_cfm/index.cfm](http://www.gsn.org/pr/_cfm/index.cfm)

**PBS Teacher Source:**

[www.pbs.org/teachersource/math.htm](http://www.pbs.org/teachersource/math.htm)

**WebQuests:** [webquest.sdsu.edu/](http://webquest.sdsu.edu/)

**WebQuest Portal:** [webquest.org/](http://webquest.org/)

**Blue Web'n:**

[www.kn.pacbell.com/wired/bluewebn/](http://www.kn.pacbell.com/wired/bluewebn/)

**ThinkQuest Library:**

[www.thinkquest.org/library/index.html](http://www.thinkquest.org/library/index.html)

**Kathy Schrock's Guide for Educators:**

[school.discovery.com/schrockguide](http://school.discovery.com/schrockguide)

**Lesson Plans Library:**

[school.discovery.com/lessonplans/](http://school.discovery.com/lessonplans/)

**Education World Math Center:**

[www.educationworld.com/math/](http://www.educationworld.com/math/)

**Education World math lessons archive:**

[www.educationworld.com/a\\_tsl/archives/math.shtml](http://www.educationworld.com/a_tsl/archives/math.shtml)

**Eisenhower National Clearinghouse for Math and Science Education:**

[www.enc.org/features/lessonplans/math/](http://www.enc.org/features/lessonplans/math/)

**Project SkyMath: Making Mathematical Connections:**

[www.unidata.ucar.edu/staff/blynds/Skymath.html](http://www.unidata.ucar.edu/staff/blynds/Skymath.html)

**Ohio Resource Center for Mathematics, Science, and Reading:**

[www.ohiorc.org/](http://www.ohiorc.org/)

**Searchable math lessons:**

[www.ohiorc.org/browse/mathematics/](http://www.ohiorc.org/browse/mathematics/)

**Ask Dr. Math:**

[mathforum.org/dr.math/dr-math.html](http://mathforum.org/dr.math/dr-math.html)

**Geometry in the Real World: Students as Architects:**

[www.glef.org/modules/modarticle.php?id=Art\\_909&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_909&mod=ms)

**Building a Better Robot:**

[www.glef.org/modules/modarticle.php?id=Art\\_908&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_908&mod=ms)

**Laptops for All:**

[www.glef.org/modules/modarticle.php?id=Art\\_895&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_895&mod=ms)

**Handhelds Go to Class:**

[www.glef.org/modules/modarticle.php?id=Art\\_955&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_955&mod=ms)

**Laptops on Expedition:**

[www.glef.org/modules/modarticle.php?id=Art\\_1127&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_1127&mod=ms)

**More Fun Than a Barrel of ... Worms?!**

[www.glef.org/modules/modarticle.php?id=Art\\_860&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_860&mod=ms)

**A Change in Attitude:**

[www.glef.org/modules/modarticle.php?id=Art\\_1029&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_1029&mod=ms)

**From Brain-Based Research to Powerful Learning:**

[www.glef.org/modules/modarticle.php?id=Art\\_1022&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_1022&mod=ms)

**MarcoPolo: Showing Teachers How to Use Rich Internet Content in Their Classrooms:**

[www.glef.org/modules/modarticle.php?id=Art\\_274&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_274&mod=ms)

**A Sampler of International Web Projects:**

[www.glef.org/modules/modarticle.php?id=Art\\_976&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_976&mod=ms)

**Apple Learning Interchange:**

[www.ali.apple.com](http://www.ali.apple.com)

**International Society for Technology in Education:**

[www.iste.org/](http://www.iste.org/)

**Thursday's Classroom:**

[www.thursdaysclassroom.com](http://www.thursdaysclassroom.com)

**Cyberbee Curriculum Ideas:**

[www.cyberbee.com/intclass.html#Mathematics](http://www.cyberbee.com/intclass.html#Mathematics)

**Teachers' First Content Matrix:**

[www.teachersfirst.com/matrix.htm](http://www.teachersfirst.com/matrix.htm)

**Intel Innovation in Education:**

[www.intel.com/education/index.asp](http://www.intel.com/education/index.asp)

**Landmarks for Schools:**

[www.landmark-project.com/index.php](http://www.landmark-project.com/index.php)

**Marco Polo:** [www.marcopolo-education.org](http://www.marcopolo-education.org)

**The Exploratorium:** [www.exploratorium.edu/](http://www.exploratorium.edu/)

**WestEd Eisenhower Regional Consortium:**  
[www.wested.org/werc/](http://www.wested.org/werc/)

**WestEd:** [www.wested.org](http://www.wested.org)

**National Center for Education Statistics:**  
[nces.ed.gov](http://nces.ed.gov)

**National Center for Education  
Statistics:TIMSS Study:**  
[nces.ed.gov/timss/educators.asp](http://nces.ed.gov/timss/educators.asp)

## Science

**PowerPoint presentation (online):**  
[www.glef.org/modules/ms/Science\\_PPT/ppframe.htm](http://www.glef.org/modules/ms/Science_PPT/ppframe.htm)

**PowerPoint presentation (download):**  
[www.glef.org/modules/ms/Science.ppt](http://www.glef.org/modules/ms/Science.ppt)

**Journey North: A Global Study of Wildlife  
Migration:** [www.learner.org/jnorth/](http://www.learner.org/jnorth/)

**JASON Project:** [www.jason.org](http://www.jason.org)

**Operation Ruby-Throat:** [www.rubythroat.org/](http://www.rubythroat.org/)

**Bugscope:** [bugscope.beckman.uiuc.edu/](http://bugscope.beckman.uiuc.edu/)

**Neuroscience for Kids:**  
[faculty.washington.edu/chudler/neurok.html](http://faculty.washington.edu/chudler/neurok.html)

**Brain Alphabet:**  
[faculty.washington.edu/chudler/alpha.html](http://faculty.washington.edu/chudler/alpha.html)

**Mail-an-Egg:**  
[www.sciencespot.net/Pages/mailegg.html](http://www.sciencespot.net/Pages/mailegg.html)

**Build a Toothpick Bridge:**  
[www.pitsco.com/Competitions/comprules.htm](http://www.pitsco.com/Competitions/comprules.htm)

**How Tattoos Work:**  
[people.howstuffworks.com/tattoo.htm](http://people.howstuffworks.com/tattoo.htm)

**The Hubble Telescope:** [hubble.nasa.gov](http://hubble.nasa.gov)

**Tracking Hubble:**  
[hubble.nasa.gov/hubble-operations/tracking.html](http://hubble.nasa.gov/hubble-operations/tracking.html)

**Hand-held Hubble:**  
[hubble.stsci.edu/fun\\_.and.\\_games/hand-held\\_hubble/](http://hubble.stsci.edu/fun_.and._games/hand-held_hubble/)

**National Library of Virtual Manipulatives for  
Interactive Mathematics:**  
[matti.usu.edu/nlvm/nav/vlibrary.html](http://matti.usu.edu/nlvm/nav/vlibrary.html)

**ThinkQuest: Library of science sites:**  
[www.thinkquest.org/library/cat\\_show.html?cat\\_id=13](http://www.thinkquest.org/library/cat_show.html?cat_id=13)

**Global SchoolNet Foundation: TESAN (the  
endangered species and nature):**  
[www.gsn.org/pr/\\_cfm/GetDetail.cfm?Startrow=1&pID=621&CurrFit=ma&sortby=ORDER%20BY%20pStartDate](http://www.gsn.org/pr/_cfm/GetDetail.cfm?Startrow=1&pID=621&CurrFit=ma&sortby=ORDER%20BY%20pStartDate)

**Global SchoolNet Foundation: Woodland  
Network:**  
[www.gsn.org/pr/\\_cfm/GetDetail.cfm?Startrow=11&pID=623&CurrFit=sci&sortby=ORDER%20BY%20pStartDate](http://www.gsn.org/pr/_cfm/GetDetail.cfm?Startrow=11&pID=623&CurrFit=sci&sortby=ORDER%20BY%20pStartDate)

**Blue Web'n Science:**  
[www.kn.pacbell.com/wired/bluewebn/contentarea.cfm?cid=11](http://www.kn.pacbell.com/wired/bluewebn/contentarea.cfm?cid=11)

**ALI: NASA Connect: Festival of Flight Special:  
Opening Space for Next Generation  
Explorers:**  
[ali.apple.com/ali\\_sites/ali/exhibits/1001064/](http://ali.apple.com/ali_sites/ali/exhibits/1001064/)

**ALI: Incorporating Technology into the  
Scientific Method:**  
[ali.apple.com/ali\\_sites/ali/exhibits/1000318/](http://ali.apple.com/ali_sites/ali/exhibits/1000318/)

**Space Day:** [www.spaceday.org/index.html](http://www.spaceday.org/index.html)

**Global SchoolNet Foundation:**  
[www.gsn.org/pr/\\_cfm/index.cfm](http://www.gsn.org/pr/_cfm/index.cfm)  
**PBS Teacher Source:**  
[www.pbs.org/teachersource/sci\\_tech.htm](http://www.pbs.org/teachersource/sci_tech.htm)

**Changing the Face of Medicine:**  
[www.nlm.nih.gov/changingthefaceofmedicine/resources/lesson\\_k\\_2.html](http://www.nlm.nih.gov/changingthefaceofmedicine/resources/lesson_k_2.html)

**Education World Science Center:**  
[www.educationworld.com/science/](http://www.educationworld.com/science/)

**Searchable science lessons:**  
[www.ohiorc.org/browse/science/](http://www.ohiorc.org/browse/science/)

**The Science Spot:** [www.sciencespot.net](http://www.sciencespot.net)

**Ology:** [www.ology.amnh.org/](http://www.ology.amnh.org/)

**Pitsco Innovative Education:**  
[www.pitsco.com/Competitions/comprules.htm](http://www.pitsco.com/Competitions/comprules.htm)

**Pitsco's Ask an Expert:** [www.askanexpert.com](http://www.askanexpert.com)

**How Stuff Works:** [www.howstuffworks.com](http://www.howstuffworks.com)

**The Maine Event:**  
[www.glef.org/modules/modarticle.php?id=Art\\_1119&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_1119&mod=ms)

**It's All Happening at the Zoo School:**  
[www.glef.org/modules/modarticle.php?id=Art\\_1010&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_1010&mod=ms)

**Biotech Academy: Challenging Assumptions and Changing Lives:**  
[www.glef.org/modules/modarticle.php?id=Art\\_1060&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_1060&mod=ms)

**JASON and the New Argonauts:**  
[www.glef.org/modules/modarticle.php?id=Art\\_907&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_907&mod=ms)

**Connecting With Experts in the Real World:**  
[www.glef.org/modules/modarticle.php?id=Art\\_468&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_468&mod=ms)

**March of the Monarchs:**  
[www.glef.org/modules/modarticle.php?id=Art\\_965&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_965&mod=ms)

**Classrooms Without Boundaries:**  
[www.glef.org/modules/modarticle.php?id=Art\\_885&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_885&mod=ms)

**Space Age Thinkers:**  
[www.glef.org/modules/modarticle.php?id=Art\\_906&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_906&mod=ms)

**Bugscope: Magnifying the Connection Between Students, Science, and Scientists:**  
[www.glef.org/modules/modarticle.php?id=Art\\_771&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_771&mod=ms)

**Latinas en Ciencia: Making Science and Technology Real for Girls:**  
[www.glef.org/modules/modarticle.php?id=Art\\_419&mod=ms](http://www.glef.org/modules/modarticle.php?id=Art_419&mod=ms)

**GLEF Learning Interchange:**  
[www.ali.apple.com/ali\\_sites/glefli](http://www.ali.apple.com/ali_sites/glefli)

**Science Resources:**  
[www.discover.tased.edu.au/science/web.htm](http://www.discover.tased.edu.au/science/web.htm)