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ABSTRACT

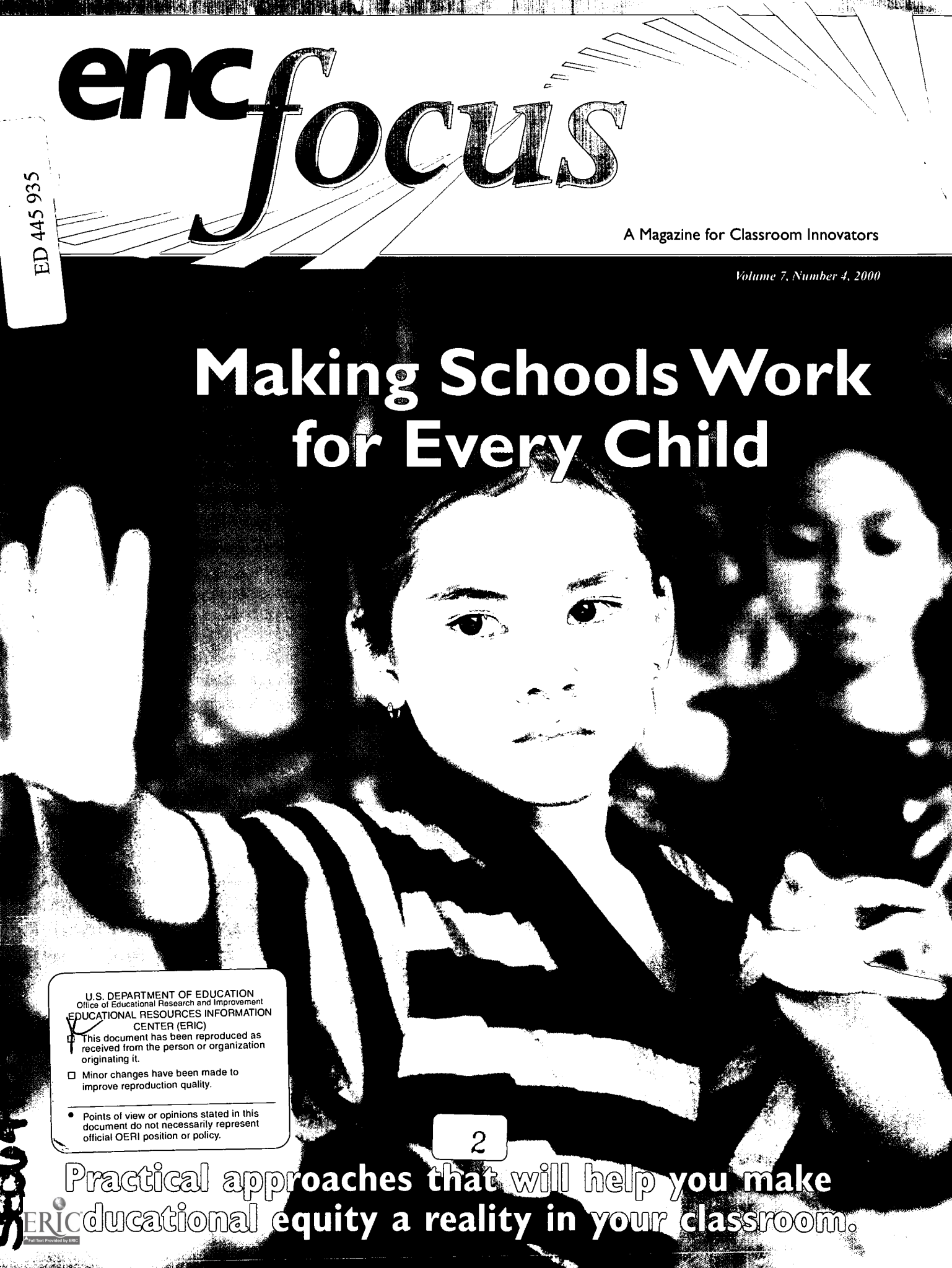
This issue of "ENC Focus" explores educational equity. Featured articles provide many perspectives on gender equity, multidimensional classrooms, technology, and special needs students. Articles include: (1) "Editorial: Educational Equity--A Moving Target" (Annette Thorson); (2) "Thinking of Each and Every One" (Francena Cummings); (3) "Teacher Fellowships Close the Gender Gap" (Janalee Jordan-Meldrum and Tina L. Coplan); (4) "CyberSisters Jumpstart Girls' Interest in Math, Science, and Technology" (Cerise Roth-Vinson); (5) "Equity in the Standards-Based Elementary Mathematics Classroom" (Christina Perez); (6) "Teaching in the Language of the Lockup" (Don Deresz); (7) "An Equity Dilemma--Teaching Gifted and Talented Students" (Gay Gordon); (8) "Serving the Underserved in Elementary Science" (Barbara Sprung and Merle Froschl); (9) "Making Technology Work for Every Child" (Patricia Hosken); (10) "Special Science Teams Focus on Abilities Rather Than Disabilities" (Sami Kahn); (11) "Teaching in an Equitable--and Safe--Science Laboratory" (Malcom S. Cheney and Kenneth R. Roy); (12) "The Search for Bias-Free Educational Software" (Carolyn Sue Gardiner); (13) "A Handful, Plus One, of Habitats: Now I Remember!" (Carolyn Cannon Jenkins and Mary M. Banbury); (14) "Student Grouping That Enhances Learning--and Equity" (Hollee Freeman); and (15) "Proyecto Futuro Brings Science to Bilingual Schools" (Madeleine Correa Zeigler). Educational news, editorials, essays, classroom stories, columns on topics of interest to classroom innovators, and an extensive annotated list of assessment resources are also included. (ASK)

enc focus

A Magazine for Classroom Innovators

Volume 7, Number 4, 2000

Making Schools Work for Every Child



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In Memoriam This issue of *ENC Focus* is dedicated to the memory of Susan Loucks-Horsley, educator, friend, and valued contributor to the work of the Eisenhower National Clearinghouse and the Eisenhower Regional Consortia.

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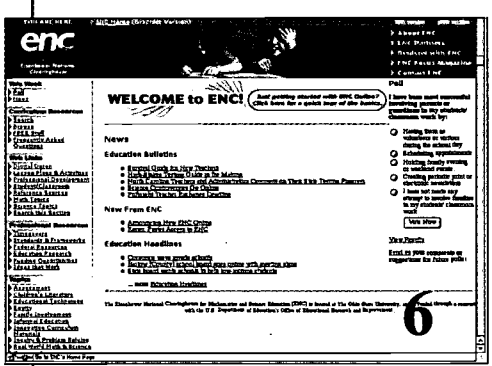
Volume 7, Number 4, 2000

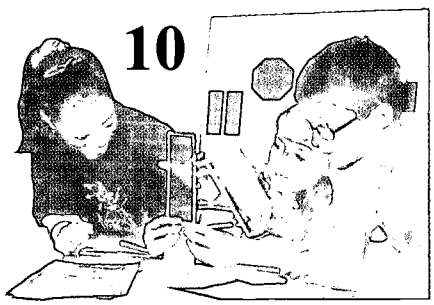
Theme for this Issue:

Making Schools Work for Every Child

Update: Around the Clearinghouse and the Nation

This section features educational news, editorials, essays, classroom stories, and columns on topics of interest to classroom innovators.

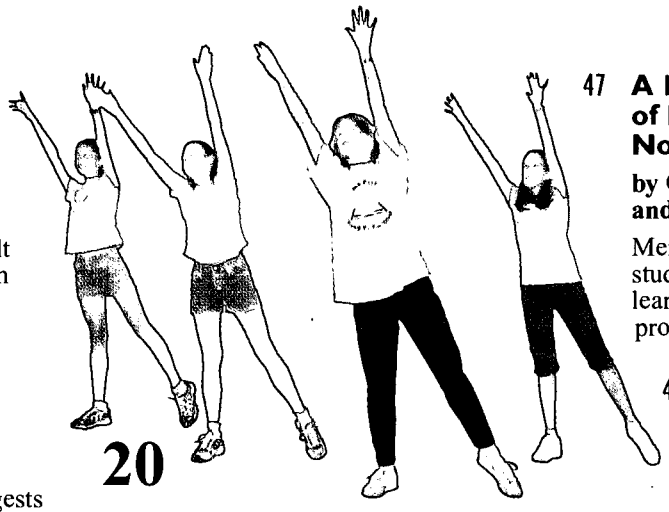




Focus on Making Schools Work for Every Child

This section presents articles on the theme of this issue.

This icon invites you to access the Internet for more information, more resources, more ideas for your own classroom innovations. The electronic version of this publication will help you get started. Visit enc.org/focus/equity



Focus on the Collection

This section presents descriptions of exemplary resources from the ENC Collection selected to illustrate this issue's theme.

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Update ...
Around the Clearinghouse and the Nation

This section features educational news, editorials, essays, classroom stories, and columns on topics of interest to classroom innovators.

Yes! *ENC Focus* has a new design: crisp, clean, readable. The goal is a magazine that is even more engaging and useful for you.

Editorial

Educational Equity— A Moving Target

by Annette Thorson, ENC Publishing

Educational equity has always been an important concern at ENC. The first issue of *ENC Focus*, published in 1994 as a 26-page "minicatalog" of resources, was on the topic Equity in the Classroom. In 1998, after several years of development and much collaboration with the Eisenhower Regional Consortia Equity Task Force, we published a CD-ROM devoted to the topic. The rich content of the CD quickly was transformed into a web site (equity.enc.org). Also in 1998, *ENC Focus* covered the topic Multicultural Approaches in Math and Science. In this issue of *Focus*, we revisit educational equity by publishing 14 new articles written by classroom teachers and other educators working in the field.

Throughout the process of creating the CD-ROM, the web site, and this magazine, we have been able to stay on track because of the clear vision expressed in the title Making Schools Work for Every Child. The title was coined by a group of our key collaborators, among them Francena Cummings, Director of the Eisenhower Consortium for Mathematics and Science at SERVE and a national advocate for educational equity. The theme section of this issue begins with her memories of how she figured out what it takes to make schools work for every child (see page 16). Teachers will not be surprised to find that she learned from the students in her science classroom.

Unfortunately, few people have had the experience and insight exemplified by Francena Cummings. To many people, educators as well as lay persons, educational equity is a difficult term "that not only means different things to different people, but also a single individual may change its connotation in a single conversation" (Lynch, 2000). Secada called it "a moving target" (1994a) and identified six conceptions of educational equity held by educators (1994b). Kahle (1996) arranged the six into a historic continuum:

- Post-Sputnik, 1957: Equity involves maximum return on the minimum investment—resources go to those most likely to succeed.
- Civil rights era, 1960s: Equity is the same treatment for everyone so that all students have an equal opportunity to meet and master standards.
- Women's movement, 1970s: Equity is concern for the whole child as an individual with unique educational, socioemotional, and physical needs.

- Women's movement, 1970s: Equity...is investing in students whose success or failure depends on their school experience.
- Affirmative action, 1980s: Equity compensates for social injustice for specific groups who have not received fair treatment.
- 1990s: Equity is a safety net for individual differences, including alternative programs or other resources, so that if one program is ineffective for an individual student, other options are available.

One would hope that everyone has rejected the post-Sputnik notion that equity involves resources going to those most likely to succeed—though some folks might still love the look of the original astronaut corps. But what about the second definition? "Equity is the same treatment for everyone." Equality equals equity. Clear, simple, easy to understand. Easy to see why members of the public would cling to the notion. Also easy to see why overburdened teachers might like to believe it.

As you read the articles in this issue, you will see that our contributors do not take the easy way out. They know that real educational equity involves meeting the different needs of each student.

Carolyn Jenkins and Mary Banbury (page 47) and Sami Kahn (page 41) focus on accommodating students with learning disabilities, while Malcolm Cheney and Kenneth Roy (page 43) provide safety guidelines for science labs serving those with physical disabilities. Janalee Jordan-Meldrum and Tina Coplan (page 20) address gender equity, as does Cerise Roth-Vinson (page 23).

Pat Hosken (page 39) describes how her district is making technology work for every child while Carolyn Sue Gardiner (page 45) considers equity issues embedded in software design.

Don Deresz (page 32) shows how the use of inquiry and problem solving brings educational equity to juvenile offenders. Gay Gordon (page 34) points out that those techniques also serve the gifted and talented, and Madeleine Correa Zeigler (page 51) demonstrates the same for students with limited English proficiency.

Different aspects of working in the highly diverse classroom are addressed by Christina Perez (page 28), Barbara Sprung and Merle Froschl (page 36), and Hollee Freeman (page 49).

Despite all these different perspectives, all of these writers have a common message: It is not easy to make schools work for every child. But it is worth it.

References

Kahle, J.B., (1996). *Thinking About Equity in a Different Way*. Washington, DC: The American Association for the Advancement of Science.

Lynch, S. L. (2000). *Equity and Science Education Reform*. Mahwah, NJ: Erlbaum, 10-15.

Secada, W.G. (1994a). Equity and the Teaching of Mathematics. In M. Atwater (ed.) *Proceedings of a Seminar on Multicultural Education in Mathematics Education*. Athens, GA: University of Georgia.

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Writer's Guidelines for ENC Focus

Detailed Writers' Guidelines are available online at

enc.org/focus/write

Here are Guideline highlights:

Articles submitted for consideration should be grounded in the national educational standards while being short (500 to 2,000 words) and compelling. It is essential that articles promote educational equity and advance the principle of "education for all." We particularly invite teachers to write about their classroom experiences, using first person and a conversational tone. Please note that library research papers written in academic language for graduate school courses are unlikely to be selected for publication. We do, however, encourage you to include a few, carefully chosen references or a brief reading list. All content must be original, and all quotations must be properly cited. ENC is not interested in publishing articles that have the main goal of promoting commercial products.

Photos or other illustrations add interest, and good illustrations increase your chances for publication. Students in laboratory settings must be shown following appropriate safety guidelines and wearing proper safety attire, including eye protection. Please note that we can use photos of children under 18 years of age only if we receive written permission signed by a parent or guardian.

Authors of unsolicited manuscripts are urged to send a brief proposal via email well in advance of the deadline for the upcoming topic. We prefer that manuscripts be submitted electronically. Each manuscript must be accompanied by the full names, postal addresses, telephone numbers, and email addresses of all authors.

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ENC reserves the right to decline to publish any article, to delay publication until a later issue, or to publish an article online and not in the print version of the magazine. ENC retains the right to make final editing decisions.

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for ENC's New and Improved Web Site

Come to enc.org and see how ENC Online is serving you better than ever!

Improvements include additional content, a new design for faster download times, and options to sign up for email services. The front page serves as a site map to the incredible wealth of content on the site, providing fast and easy access to hundreds of web links and classroom resources.

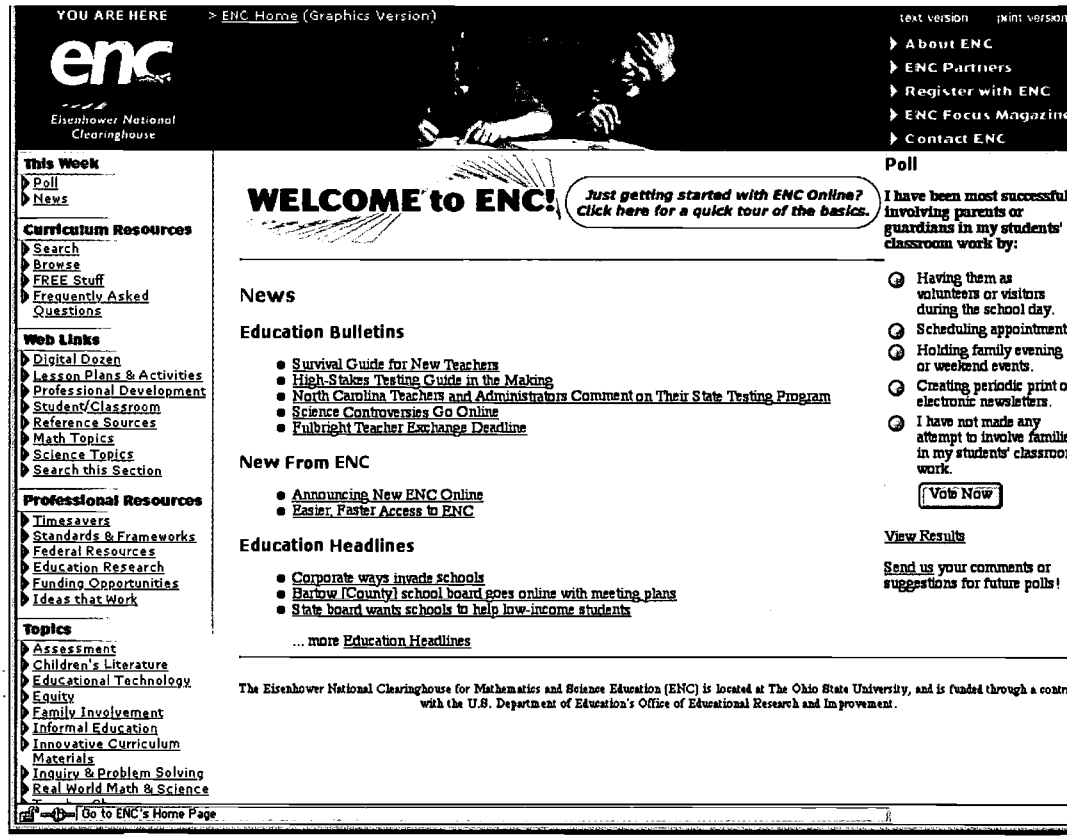
The new home page uses words describing the contents of the site in terms of what teachers tell us they are looking for when they come to ENC Online. Here's a brief overview of the major categories:

Curriculum Resources. In this area of the site, you can use a simple or advanced search to locate all types of teaching materials in ENC's collection of more than 17,000 items. The searches allow you to choose particular subject words, grade level, cost, and type of material to find exactly what you need for your classroom situation.

Web Links. Check this category for ENC's popular Digital Dozen feature. This monthly selection of exemplary math and science web sites can also be delivered to your email box if you choose to register. Web Links also connects to hundreds of sites with math and science lesson plans. A search feature helps you find Internet resources quickly and efficiently.

Professional Resources. This portion of the site is designed as a teachers' professional support system. ENC has gathered some of the most popular professional resources in one Timesavers area for quick linking and use. This section also provides links to the national mathematics and science education standards, and state frameworks are listed conveniently by state. Federally funded resources and professional development strategies are also available here.

Topics. Hundreds of articles, teacher interviews, and selected curriculum resources and web sites are arranged thematically in this area. Topics include inquiry and problem solving, educational technology, equity, and assessment. Many of these topics include the content developed for *ENC Focus*.



The new ENC Online also has a quick way to get to each issue of *ENC Focus*—try the ENC Focus Magazine area of the web site to access each table of contents. In this area, you can also sign up for a free subscription to all future issues of the print magazine.

Visit enc.org to see the new web site. If you have already visited ENC Online, you'll notice how much we've changed. If you have never visited before, now is the time. We've made using the Internet in your profession easier than ever!

WEEA Equity Resource Center

Gender equity in education is the mission of this organization, one of many that collaborate with ENC.

by Gay Gordon, ENC Publishing

In 1974, the Women's Educational Equity Act (WEEA) established a program to promote gender equity in schools and other community organizations. The law created an annual grant competition administered through the US Department of Education, as well as a national resource center designed to support the work of these grants and disseminate the learning.

Since its founding in 1976, the WEEA Equity Resource Center has been housed at Education Development Center in Newton, Massachusetts. Originally it served as a technical assistance center and publishing house for WEEA grantees, but it has broadened its reach over the years. Currently, the WEEA Center has published more than 350 titles on gender equity issues and provides technical assistance to implement and expand gender equity programs in the larger K-16 education community, with special emphasis on underserved populations of girls and women. In 1998 the Center responded to more than 1,200 technical assistance requests on topics such as sexual harassment, gender equity awareness, mentoring, and effective classroom practices.

The WEEA Associates program began in 1998. It enables the WEEA Equity Resource Center to extend its reach by working with other organizations that are willing to assist WEEA in accomplishing its mission. WEEA Associates are located throughout the country and can respond to technical assistance requests in their regions in a cost-effective manner. WEEA Associates are affiliated with a wide variety of organizations, including Comprehensive Assistance Centers, universities, regional education labs, mathematics and science consortia, state departments of education, and other organizations devoted to gender equity issues.

Beyond providing technical assistance, Associates agree to work with WEEA in several ways, including facilitating online discussions, representing WEEA at conferences, reviewing and/or writing publications and other materials, and providing information and resources for the WEEA web site (www.edc.org/WomensEquity). In turn, WEEA supports the Associates program by holding a yearly orientation and updating Associates on activities; maintaining a private listserv; providing copies of all WEEA publications; supplying WEEA materials for conferences and meetings; marketing the availability of the Associates program; and providing monthly updates on WEEA activities.

ENC participates in the WEEA Associates program, and I am the contact person. ENC includes WEEA publications on issues related to math and science education in our online catalog of resources. This year, we also expect to feature one of the Equity Center's important products, an online course for educators, "Engaging Middle School Girls in Math and Science."

I have worked with the WEEA Equity Resource Center over the past year to facilitate an online discussion on women in science and then to prepare a companion publication. The online discussion included several national and international panelists who raised numerous issues concerning women as full participants in science as a profession. The issue with which I am most concerned is maintaining girls' interest in science beyond the middle school years. Many people participated in the discussion, sharing their concerns, programs, and ideas. It was a very lively discussion, and the publication is in the works.

To subscribe to the EDEQUITY listserv, send an email message (majordomo@mail.edc.org). The subject must be left blank and the body of the message should read: subscribe edequity (no quotation marks or other punctuation).

For additional information about WEEA services or the Associates program, contact:

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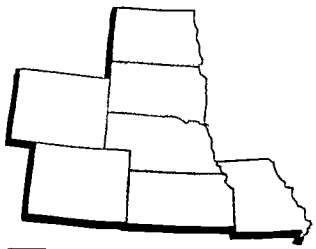

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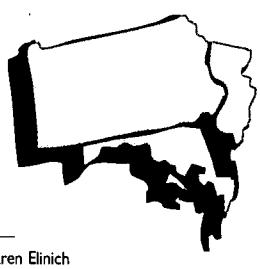

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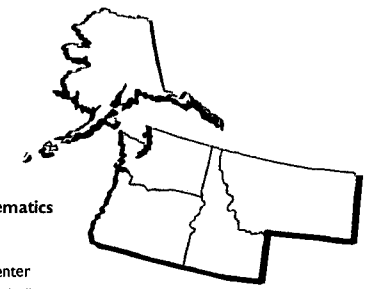

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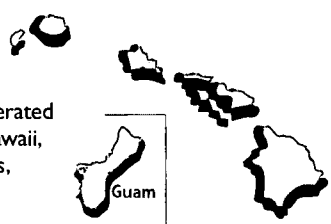

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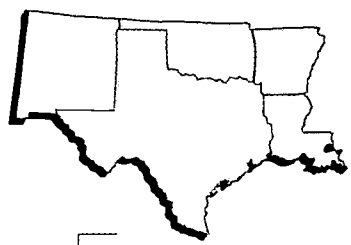

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URL: www.gwu.edu/~immc/

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Wonder World Inspires Learning

Creating their own ideal vacation spot tied together the entire curriculum and led to yearlong learning and excitement for this class of fifth graders.

by Winnifred G. Bolinsky, Fogelsville Elementary School, Allentown, Pennsylvania

What teaching and learning approaches capture the hearts and minds of elementary students, transforming abstract concepts and complex skills into valued understanding and usefulness? I believe that the best way to start is to allow students to take control of their own learning. In creating Wonder World, my fifth graders constructed a yearlong adventure brimming with opportunities to creatively apply and synthesize their math and science curriculum.

My role was to guide and facilitate their learning through an inquiry-based environment. Together we managed our time, space, and resources to maximize our learning endeavors.

Persuasive Posies

Originally, Wonder World was one of five proposals for yearlong projects developed by the students in September. I provided guidance so that student groups could propose projects that were broad enough to permit integration of our curriculum—what we call the big picture.

The student groups used their knowledge of plant parts to create Persuasive Posies to present their proposals (see photo). The parts of their plants served as graphic organizers, with the taproots and secondary roots containing what it would take for the class to accomplish their project goals.

To give the students experience in public speaking and to introduce the concept of market research, each group presented their project ideas to the fourth graders in our school. Wonder World, a project in which students would create the ideal vacation spot, won the fourth-grade vote as the most interesting project.

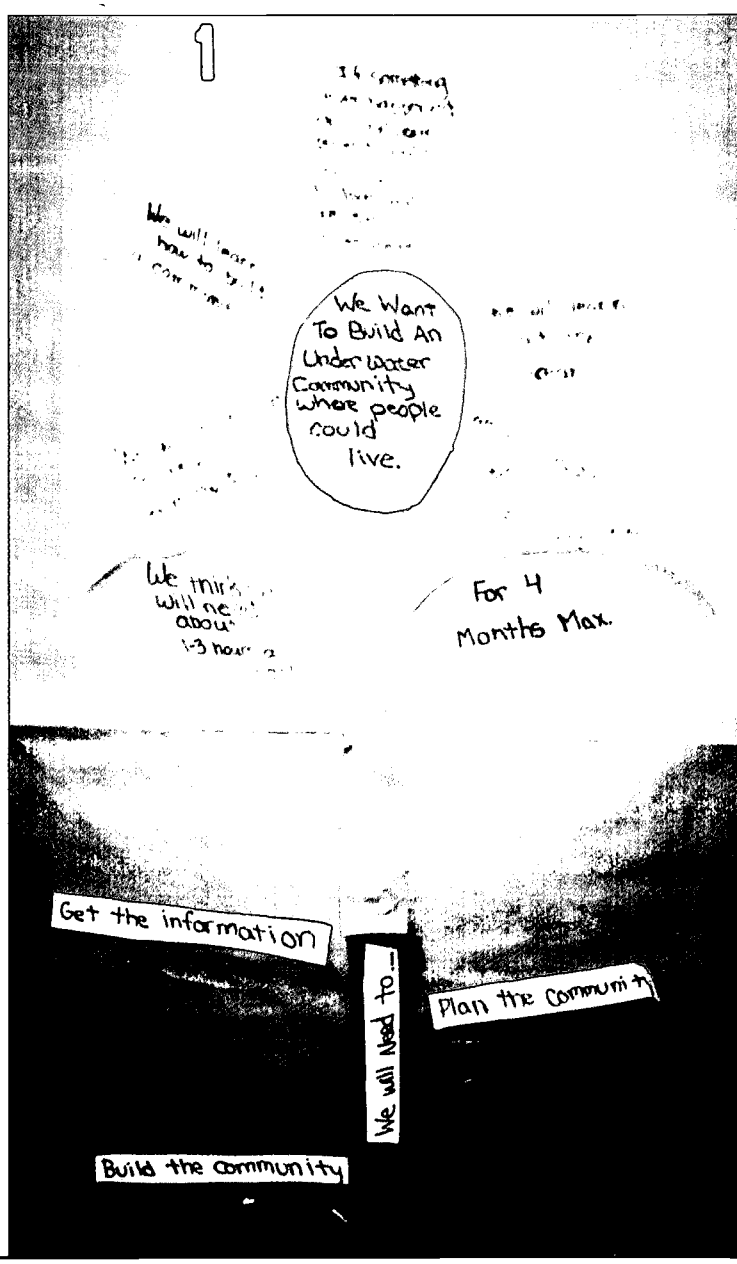
Data from the voting were tabulated by class and gender. The students created a wall-sized graph and were able to analyze the fourth graders' preferences based on these demographics. Students also produced numerous computer-generated graphs that they examined for a variety of trends.

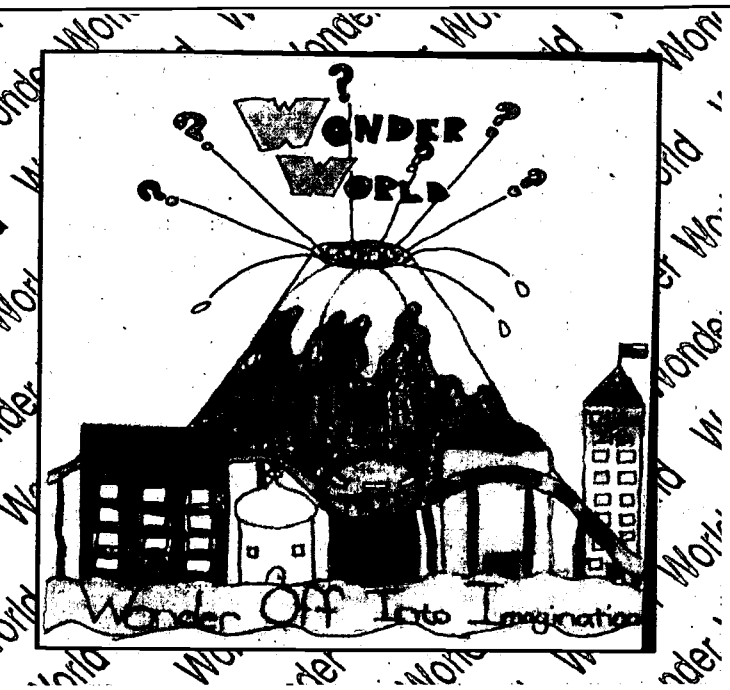
Though only one project could be chosen, it didn't take long for the students to recognize that their ideas and efforts would determine the outcomes for Wonder World. They also saw that the other four project ideas were not necessarily defunct. For instance, the students who proposed colonizing Mars as a potential project were able to channel that enthusiasm into designing the Trip to the Planets ride for Wonder World.

See the students' writing (page 12) for their perspective of what they are learning in designing such Wonder World attractions as the Biome Bed & Breakfast and the Habitat Hotel.

Wonder World Across the Curriculum

As the year progressed, Wonder World continued to merge elements of our curriculum. A study of the properties of light and electrical circuits provided basics for lighting the octagonal lobby of the Biome Bed & Breakfast. Concepts from physics supported our design of rides and other entertainment for this unusual vacation spot. Research and experi-





ments provided students with the background to design and model a volcano tour.

In addition to the Biome Bed & Breakfast and Habitat Hotel, students analyzed real animals and created imaginary ones for their Portmanteau Petting Zoo. They incorporated idioms in the design and construction of the Idiom Inn.

Experts in the field supported students' endeavors by sharing their knowledge with the class. We visited the Allentown Art Museum, where students learned more about architecture and design. They also experienced the museum's library exhibit designed by Frank Lloyd Wright. Students analyzed practically everything we did to determine its potential for their Wonder World.

Throughout the project, we had far more questions than answers, more dreams in progress than quickly completed assignments. It takes time to absorb concepts and time to use them and related skills with relative ease and creativity.

Outcomes

Several students traveled to Harrisburg to share Wonder World's technology integration with state legislators and the public at the Pennsylvania Association for Educational Communications and Technology (PAECT) Student Capital Technology Showcase. Our students were able to demonstrate how the Internet, concept mapping, desktop publishing (of advertisements, brochures, invitations, posters, programs), graphing, and word processing supported Wonder World endeavors. Students also produced an extensive PowerPoint presentation depicting the elements of Wonder World.

Perhaps the most revealing outcome was the play scripted and performed by the entire class, "Wonder World—The Play." The script indicates the impact that cooperative learning, long-term goals, and creative applications of content have on student motivation and success. The play was performed for the school, families, and community members. Students published their script in book form through a grant from the Milken Family Foundation and Chapbooks.com.

By the end of the school year, much of what we did in mathematics and science, as well as other curriculum areas, showed up in Wonder World, where, to quote the students, visitors can "wonder off into imagination."

Winnifred G. Bolinsky teaches fifth grade at Fogelsville Elementary in Allentown, Pennsylvania. She is also a doctoral student at Curtin University.

Students "Wonder Off into Imagination"

Winnie Bolinsky's fifth graders were eager to share what they learned in designing and building Wonder World (see page 10). Here are some excerpts from their writings throughout the project.

Wonder World is the ideal vacation spot. There will be restaurants, rides, and a great selection of attractions!

We have been using a lot of geometry for the Biome Bed & Breakfast. We learned a little about Frank Lloyd Wright, who was a famous architect. He sometimes worked with stained glass. Therefore, we are making stained glass windows for each biome at the Biome Bed & Breakfast.

In math, we made tessellations, or patterns. Some people used the tessellations for wallpaper in the habitat room they are designing by scanning the designs on the computer and decreasing their size.

In science we are learning about light and sound by reading and doing experiments. We can use those skills to light up some of the attractions and signs throughout Wonder World. That will make things look very interesting!

We designed a Wonder World logo and made our own T-shirts. We took designs from the T-shirts and used them for a background on the computers in the classroom.

We will need math and science for many other things in Wonder World, such as making precise measurements on the buildings to make them as perfect as can be. I predict, by the end of fifth grade, we will be experienced enough by all the measuring and building that we can possibly become a famous architect such as Frank Lloyd Wright.

Charlotte Barna Charlotte

During our year so far, we have measured angles, created diagrams, made concept maps, learned to use computers, and, most of all, learned to work together. While having fun, we have learned *immensely* about language arts, natural life, geography, and math.

I, myself, had had it pretty easy the past few years. But Mrs. Bolinsky has really opened my eyes. I probably learned twice as much information this year. We have learned all about Earth's different biomes and habitats.

We also could not do anything without math. For example, we need to make sure all of our squares and rectangles have 90-degree angles. We are also making lots of pictures with geometrical shapes.

Jack Stanley Jack

One of the projects we did involved math. We did tessellations with squares that were four inches on each side. We came up with designs on two sides of a square, cut them out, and slid them to the opposite sides. Then we had to look at the shape and make it into something. Many people came up with good ideas. I decided my design looked like an elephant, so I ended up doing a pyramid of elephants.

For our Habitat Hotel, we had to pick an animal and learn about its habitat, so I picked the African elephant. We had to design a room on centimeter graph paper, then do a color drawing of the room. For my room, I chose my wallpaper to be my tessellation.

In the Biome Bed & Breakfast, we are putting a lot of math skills into the building. The building has a big octagon center with eight rectangles coming off of it. The rectangles are for eight biomes: rain forest, grasslands, tundra, freshwater, marine, desert, coniferous forest, and the deciduous forest. There will be eight restaurants, one for each biome. They will be in the shape of a trapezoid. Then, in the middle of the octagon, there will be a circle. It is an information desk and a check-in desk. We have to make sure all of the angles are perfect and that the lines are perfectly straight.

Next we are doing food stands. They have to serve food that is healthy in some way. We have to make a menu and research the nutrition of the different foods.

At the end of the year we will put on a play about what we learned while doing Wonder World. I'm so excited! I cannot wait till it's built.

Nicole Ruddy Nicole

The math and science we use in the Wonder World project helps us to see that the skills we learn will be useful in our lives. I plan to be a biologist, so one of the most interesting things was designing the Habitat Hotel.

The math is going to help me design habitats that are perfect for animals and birds. It helps us to estimate how big the animals will get and how much room they need to exercise. The science taught me about the animals and their environments and what they need to survive.

Kirk Miller Kirk

It is hard work, but Wonder World is coming along great. We have just finished one tower of one of the many hotels we're doing, the Habitat Hotel. We have to measure 90-degree angles or the whole model will be off. It's hard.

In math we learn to do difficult problems. We also learn to use special buttons on our calculators to make the problems easier and make them go faster. When we grow up, if we become engineers, scientists, or mathematicians, or whatever we want to be, things will go a lot faster.

In science we do cool projects. My favorite project was when we had to light a light bulb using one, two, then three batteries, to see the difference in the light.

Mario Machado Mario

Some students did scale drawings of the layout of the Biome Bed and Breakfast, which required careful measuring. The layout uses many geometric solids and plane figures. Other students drew the pieces we would need to make the building on foam board, and we are now cutting them out.

We designed stained glass windows for our biomes, using only geometric plane figures. We scanned them on to the computers and printed them out on transparencies so they would look like real glass. After we finish our science unit on light, we will put a light bulb in the center of the building so that the windows will glow.

The Idiom Inn is a restaurant in Wonder World. We made ads for it and we scanned them on the computer. We are going to design menus with the food prices.

In math we did questionnaires on food to see which foods are the most popular. We typed them on the computer and printed them out. We are going to have the fourth graders in our school answer them. We will make food stands for Wonder World using the information they give us.

Wonder World is not done yet, but we have planned some of the things we will do. We are going to make a timeline showing the steps in Wonder World's creation. We will also make models of some amusement park rides, including a Trip to the Planets. At the end of the year our class will put on a play for our school using what we learned.

Heather Friedberg Heather

ENC Celebrates Your Students

"What's wrong with our schools" is a pervasive topic, especially in an election year. But teachers tell us that they wish that someone would focus on what is right: the wonderful young people who grow in so many exciting ways right before their eyes. This is the second in a series of features showcasing the learning that happens every day in schools all over the country.

You can take part in this effort by sending student work that demonstrates their involvement in mathematics, science, and technology. As is illustrated in this article, the submission needs to include a brief introduction written by the teacher. Student artwork increases the likelihood of publication, but we can return it only if you provide a self-addressed, stamped envelope of adequate size. Please be selective; students can help evaluate their peers' work and choose the best for submission.

Submit electronically by attaching files to email:
athorson@enc.org
Or mail to:
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For general guidelines on writing for *ENC Focus*, see page 5.

Virtual Manipulatives: A New Tool for Hands-On Math

Go online to experience the power of virtual manipulatives to demonstrate math concepts in ways not possible with physical objects.

by Judy Spicer, ENC Instructional Resources

ENC's virtual manipulatives presentation at the National Council of Teachers of Mathematics convention in Chicago began with a question and ended with a collective "Wow!"

Here is the question:

Why use the Internet for instructional purposes in the middle school mathematics classroom?

One answer is that the Internet enables the learner to see and explore concepts not readily accessible in other mediums. For example, virtual manipulatives offer computer-generated objects that can be manipulated by a computer user. Virtual manipulatives have the power to make visible that which is hard to see—and impossible to imagine.

During the presentation, we demonstrated sites that make it possible to interactively explore the relationship between the equation of a line and its slope, to see an image of a fourth dimension hypercube, and to begin to get a feel for infinity. The visual beauty of the mathematics found at these sites created excitement in the audience, and we believe, will wow even the most uninterested students.

In preparing our presentation, we set out to find challenging and exciting interactive Internet experiences useful in grades 5 to 8. Here are a sampling of our favorite sites arranged by topic. After reading about them, go online and really explore what the sites have to offer. Be prepared to say "Wow!"

Fractals

Visit Cynthia Lanius' site (math.rice.edu/~lanius/fractals) for activities and lessons for learning about and exploring fractals online with both virtual manipulatives and physical models. The activities illustrate the iteration and self-similarity that are characteristic of fractals. In a Sierpinski Triangle, the midpoints of the sides of an equilateral triangle are connected with three lines, forming four triangles similar to the first. The iterative process continues by connecting the midpoints of the newly formed triangles, creating a pattern of smaller and smaller triangles.

The wow on this site is seeing, on screen and in color, the iterative process as the details in the original triangle grow more complex. After six iterations, there are 364 triangles in a variety of colors contained within the original triangle. This site includes a series of questions for exploring the mathematics found in the ratios between the shaded and unshaded portions of the original triangle. Activities also include directions for creating paper models of the Sierpinski Triangle.

In the second fractal example from the same site (math.rice.edu/~lanius/frac/jurra.html), a paper model and a JAVA Applet can be used to simulate a fractal found in the book *Jurassic Park*. The Dragon Curve, or Jurassic Park Fractal, can be created with a strip of paper, 11 inches by 1 inch, that is repeatedly folded in half, left over right. The unfolding of this strip is an iterative process for creating a self-repeating pattern. The JAVA Applet (www.best.com/~ejad/java/fractals/jurasic.shtml) permits the user to go beyond the physical limitations for paper folding and to see the result of 15 iterations showing 32,768 lines.

Fractions

Next, we suggest exploring fractions with two very different physical representations. At the first site, Pattern Blocks: Exploring Fractions (www.best.com/~ejad/java/patterns/patterns_j.shtml), the learner can experiment with what it means to be a fractional part of a whole with online pattern blocks, which are modeled on the familiar plastic blocks. Pattern blocks—either virtual or real--can be used in conjunction with activities from No Matter What Shape Your Fractions Are In (math.rice.edu/~lanius/Patterns/).

The second site, Visualize Fractions (www.visualfractions.com), features number line representations for fractions and detailed instructions for the arithmetic operations on fractions. The activities are suited for the student who needs practice with fractions and includes a number line-based game for practicing skills.

Graphing

Have you ever thought equations weren't very visual? Check out ExploreMath.com (www.exploremath.com/activities /index.cfm) with interactive models for graphing related equations and formulas. Featured concepts range from the distance formula and the point-slope form of a linear equation to trigonometry and probability applications.

The Zona Land web site (id.mind.net/~zona/mmts/mmts.html) offers virtual manipulatives for exploring the link between the constants found in polynomial equations and their graphs. Also try exploring the effects of changing the constants in second-degree polynomials (id.mind.net/~zona/mmts/functionInstitute/polynomialFunctions/graphs/degree2PolynomialFunction.html).

Pythagorean Theorem

Let's look at virtual manipulatives that offer more visual proofs of the Pythagorean theorem than you ever thought existed. Math Cove offers a sophisticated Pictorial Proof of the Pythagorean Theorem (www.utc.edu/~cpmawata/geom/geom7.htm).

At Manipula Math with JAVA (www.ies.co.jp/math/java/index.html), the Middle School section features 88 Applets including nine interactive verifications of the Pythagorean Theorem and an Applet for exploring the Pythagoras tree fractal. This fractal ends up having a broccoli stalk form. Also found at this site are virtual manipulatives for exploring hundreds of mathematical ideas including the size of the exterior angles of a polygon and the ratios found in the length, width, and area of rectangles.

Three-Dimensional Solids and More

For mathematical beauty, spend time at Virtual Reality Polyhedra (http://www.georgehart.com/virtual-polyhedra/vp.html). This site offers online interactive images of complicated three-dimensional figures that can be rotated and repositioned for study. Instructions for creating paper models are included. At JavaSketchpad DR3 Gallery (www.keypress.com/sketchpad/java_gsp/gallery.html) the learner can explore the nine-point circle, conic sections, and form the image of a hypercube (www.keypress.com/sketchpad/java_gsp/hypercube.html).

Data Analysis and Probability

Finally, the National Council of Teachers of Mathematics has created a web site, i-Math Investigations (illuminations.nctm.org/imath) to support the teaching and learning of concepts found in the Principles and Standards of School Mathematics (PSSM). A virtual manipulative for grades 6 to 8 can be used to explore the relationship between theoretical and experimental probability. The learner selects a set of numbered tickets to enter in a virtual box. This program randomly draws numbered tickets from the box, repeats allowed, and creates a bar graph illustrating the experimental probabilities for the drawn tickets. With a mouse click, the investigator can also see the related theoretical probabilities for the drawn tickets.

Judy Spicer is senior mathematics abstractor for ENC. This article is based on a session she and Terese Herrera, ENC's mathematics education specialist, presented at NCTM's National Meeting in Chicago on April 13, 2000.

Connect to all the sites described in this article via the electronic version of this magazine (enc.org/focus/equity). All the suggested sites have been featured on ENC Online as ENC Digital Dozen selections. Digital Dozen is a monthly collection of outstanding web sites for teaching and learning mathematics and science.

A National Organization That Works Locally, Too

ENC Focus ***often features stories about how ENC builds partnerships that extend its reach to educators around the country (see page 7). While most of its work is on a national scale, ENC recognizes the importance of connecting with its own community to help improve math and science achievement.***

by Julie Ditty, Ohio Hunger Task Force, Columbus, Ohio

The Ohio Hunger Task Force (OHTF) was founded in 1970 by community volunteers concerned about the effects of hunger on communities. Today, OHTF provides nutritious meals to more than 10,000 children each day. The Task Force is committed to finding a long-term solution to hunger; their mission is to enhance the well being of children and families by meeting immediate child nutrition needs and advocating for the elimination of hunger through education.

OHTF has asked ENC to get involved with an after-school enrichment program. In central Ohio alone, approximately 1,000 at-risk students participate in educational and recreational activities at 35 after-school centers that partner with OHTF.

Besides delivering nutritious meals to program participants, OHTF provides the materials and the volunteers to offer a wide variety of enrichment activities, including a cooking curriculum, environmental education, nutrition education, and a series of 4-H-sponsored activities. ENC is helping with a series of hands-on math and science activities to add to the list.

This is a valuable opportunity to capture a child's interest in math and science in a setting outside the classroom. Research has shown that children attending after-school programs have better grades and proficiency scores, attend school more regularly and are tardy less often, and have fewer disciplinary problems than they did before attending the programs. ENC is a natural collaborator in this effort.

Reference

More information about the benefits of after-school programs is available in *Safe and Smart: Making the After-School Hours Work for Kids*, a joint publication of the US Department of Education and the US Department of Justice. The 1998 report, which provides an extensive list of research citations, is available online (www.ed.gov/pubs/parents/SafeSmart/). You can also connect to it via the online version of this magazine (enc.org/focus/equity).

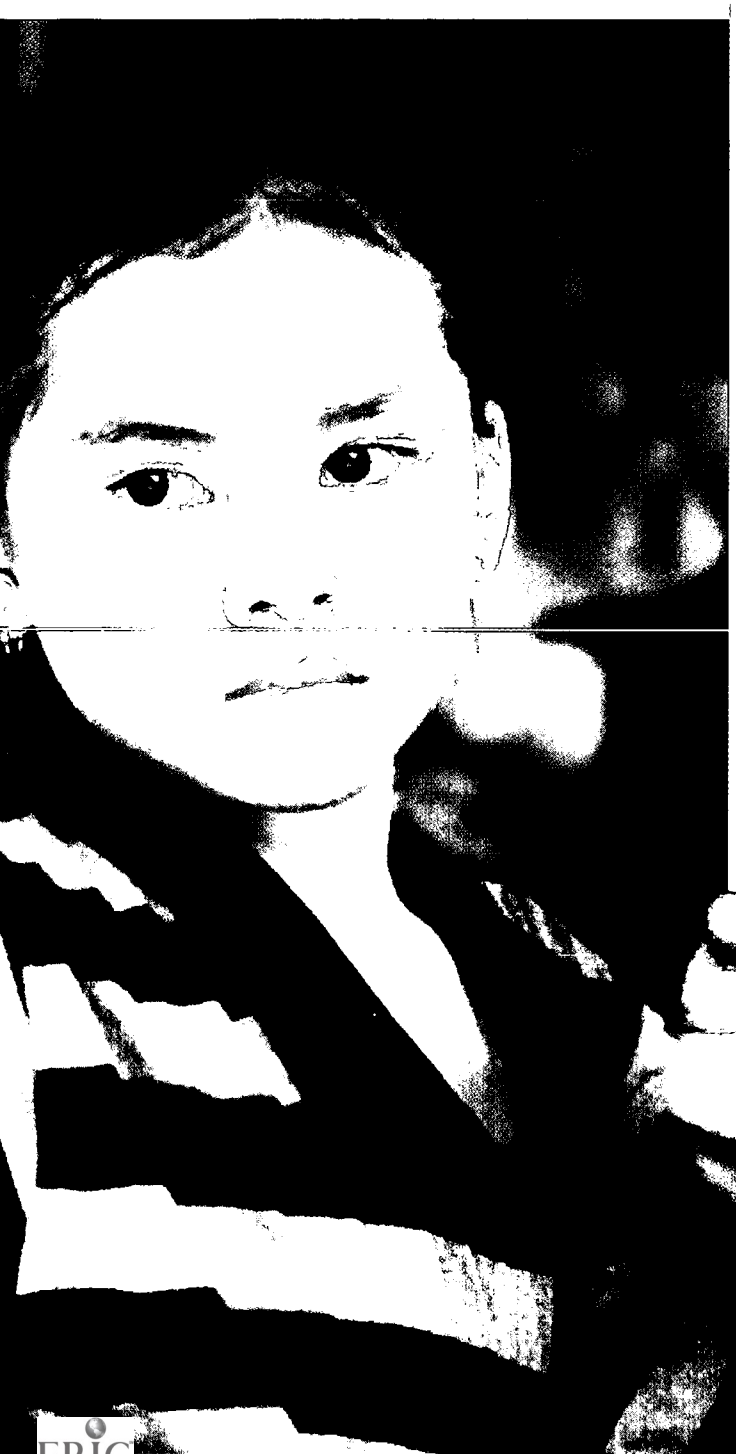
Thinking

Focus on

Making Schools Work for Every Child

Educational equity remains a challenge, as illustrated by the articles in this section.

# of Each and Every One



In her own years as a teacher, this national advocate for educational equity learned to consider the needs of each child in her classroom.

by Francena Cummings, Eisenhower Consortium for Mathematics and Science at SERVE, Tallahassee, Florida

At the center of the notion of educational equity is the hope that schools can serve as the equalizer for many of our citizens. If we are going to make that happen, we have to create the environment and the conditions so that all children can achieve. That can happen only when students feel good about who they are and when they are given the kinds of tasks and teaching that will allow them to learn.

I speak from the perspective of having taught science for many years, mostly in middle school. First and foremost, I knew I had to be prepared to teach the material. If I knew my subject matter, I would be able to prepare the conditions and provide quality tasks for all of my students. Next, I had to think of all the other factors that can affect student learning. I had to think in terms of who the students are and what they bring when they come into that classroom.

I constantly reminded myself to think about that classroom full of students as individual learners and to plan instruction that would help each one achieve as much as possible. I never had a preconceived notion about what my students could do. I always tried to accept them—and whatever they brought—and to begin working with them at that level.

But no matter how much we try to understand our students as individuals, we have to recognize that we are all a part of the larger society. We teachers are members of our own ethnic or cultural groups, so naturally a diverse classroom is a challenge.

Again, I speak from my own experience as a person who was brought up in segregated schools. I had grown

up and started teaching in all-black schools. That was my life. When I moved into integrated situations, I did a lot of observing and listening. I learned the truth of the old saying, "you are more alike than you are different."

Overcoming Our Own Biases

Even when you believe you are sensitive to the needs of individual students, you may find you have biases that you do not recognize. I came to grips with this during my first experience teaching students who were not fluent in English.

The school district where I was working experienced an influx of families from Vietnam. When we first started working with these students, we had the notion that they would be able to learn the material when they could understand the language. Until then their lack of English was going to be a significant barrier. When the Vietnamese students came into my classroom, I put them in groups with other students who would be helpful. I encouraged students to facilitate the lessons for the newcomers.

I felt I had handled things well. Then one day, I noticed that one Vietnamese student continued to watch what I was doing with the other groups, even though I had given him another task. Finally he began to tug at my jacket to tell me "I can do it!"

It was a telling moment when I realized I had underestimated that student. As a result, I began to look beyond English proficiency. I recognized that the newly arrived students could build on what they brought from their native land long before they learned to speak English. I also learned to look carefully at my own preconceptions and how they might prevent me from recognizing the strengths of each individual.

Each of us have our own biases that we must acknowledge and address. For many people, gender bias is so unconscious that we might not recognize it. As much as we want to think that we would not promote males over females, we need to ask questions as basic as, "Do I actually call on the boys more than I do the girls?" We have to be mindful of ways we can encourage both boys and girls, especially in math and science.

Making the Classroom a Home

One of the best ways we can serve each individual is by making our classrooms loving, homelike places. The students can help us accomplish this.

As a teacher, I always spent a significant amount of time in the early part of the year developing that feeling. Students need help in understanding the whole notion of self-respect, which leads to respect for each other as people and finally respect for each other as learners.

It is important for students themselves to acknowledge that some of them are going to learn more quickly than others, but that does not mean that we do not honor a student who may have a different learning style. The whole class can work together to respect each person and help provide whatever it takes to get him or her where he or she needs to go.

Reaching Beyond the Classroom

Making everyone in the class comfortable is a big responsibility that I think is still left to the individual teacher. However, it is important for the administration to assist in that effort. We as teachers get our cues from our leaders. Administrators need to show that they value teachers, especially where there have been gaps in achievement levels. Teachers can try to do it on their own, but it is so empowering to know that their school is about achievement, and it is not just about achievement for a few—it is about achievement for all.

Administrators' support is very important in relationships with parents. Sometimes parents question unfamiliar teaching styles; some parents don't buy into cooperative learning, for example. Teachers need the administrator to say, "You know, in this school, we support that kind of climate because we believe it is very rewarding for our students."

I believe all parents like to perceive their school as high achieving. They want to feel that their schools are doing the best for their children. Of course, their own children are parents' first concern, but many parents realize that the school that is not working for the majority of the students is not going to be the best place for their own child.

Making Progress

The challenges of making schools work for every child are great, but I believe we are doing a better job. We have improved our ability to serve students with learning disabilities or physical or emotional handicaps in the regular classroom setting, and those students have benefited greatly.

When it comes to achievement differences between white children and children of color, we still have gaps, but we have made progress there as well. Recent discussions on the achievement of minority students emphasize the complexity of this issue, but somehow it always seems to come back to expectations. Do we really believe that all children can learn? If we believe that all children can learn, how do we—not just teachers but all other members of the education community—act on that belief? For example, school boards set poli-

cy about class size, school improvement processes, and resource allocation. If schools are to work for every child, the entire system must be accountable.

We educators must continue to develop our skills in serving all students, regardless of background. We must strive to understand the various cultural influences that come into our schools. We have to think about ways to interact with those cultures, learn from them, and make them a part of the learning situation for all our students.

We have to beware of looking at this whole notion of equity from the perspective of access. Making schools work for every child is more than just putting a student in a satisfactory situation. We have to put the policies and practices in place to facilitate that child's learning.

Most of all, for many of our disadvantaged children, somehow we have to show them that there is a payoff, that school achievement is going to make a difference—to get them that job, to start them on their way to being productive citizens, and ultimately to help them understand their world. For that to happen, educational equity must be reflected throughout our society.

Francena Cummings is Director of the Eisenhower Consortium for Mathematics and Science at SERVE (see page 9). She was a teacher in the Montgomery County Public Schools, Maryland, where she also served as teacher specialist and staff developer in the district's Department of Quality Integrated Education Program.
Visit www.serve.org/Eisenhower or call toll-free (800) 854-0476

Teacher Fellowships Close the Gender Gap

An AAUW Educational Foundation program supports teachers working to encourage girls' interest and achievement in mathematics, science, and technology.

by Janalee Jordan-Meldrum and Tina L. Coplan, AAUW Educational Foundation, Washington, DC

The gap between girls' and boys' achievement in mathematics and science may have narrowed in recent years, but research conducted by the American Association of University Women (AAUW) Educational Foundation (1998, 2000) indicates a growing disparity between the genders in technology. To encourage girls' involvement in challenging math, science, and technology coursework and activities, the Foundation awards fellowships and grants for projects that bring together schools and communities.

Each year, the AAUW Educational Foundation's Eleanor Roosevelt Teacher Fellowships provide grants of up to $9,000 for individual teachers to design projects that will give girls a jumpstart in math, science, and technology. The fellowships also support professional development coursework and an annual Teacher Institute in Washington, DC. During five days of intensive sessions, Eleanor Roosevelt Teacher Fellows learn about the latest gender equity research, exchange ideas with leading professionals and each other, and gain insight into strategies and resources to help expand the reach of their projects.

Another Foundation program, Community Action Grants, provides up to $7,000 for one-year and $10,000 for two-year, community-based projects to advance education for girls and women. (See page 23 for an article about CyberSisters, a program supported by the Community Action Grants program. An article describing other projects funded by the program will appear in an upcoming issue of *ENC Focus*.)

The Eleanor Roosevelt Teacher Fellows featured in this article exemplify how teachers can use imaginative approaches to promote gender equity in math, science, and technology. These programs succeeded in inspiring girls, while also benefiting boys and the teachers involved.

A Mentoring Program Benefits All

High school science teacher Gilda Lyon and elementary school teacher Jacqueline Whaley teamed up to create a mentoring project between teenaged girls studying math and science at inner-city Howard School of Academics and Technology in Chattanooga, Tennessee, and African-American girls in the fourth and fifth grades. The 20 mentoring pairs easily visited each other's classes, since the elementary and high schools are located in connecting buildings.

The program reached beyond the walls of the school. The girls visited with professional women working in math and science and participated in outdoor adventures including rock climbing and back packing. They also took science activities, such as water and soil testing, out into the field.

The project demonstrated that promoting gender equity in schools benefits all children. The popularity of "sister science" prompted boys in Lyon's class to lobby for their own program. So "brother biology" was established. Lyon helped the boy mentors to develop science lesson plans based on their recent studies and on the school district's mandated curriculum for the elementary students.

Photo by Nick Waring

Gilda Lyon

In their new role as peer teachers, the older students discovered a strong motivation to learn. As Lyon explained, "Most high school kids are only interested in understanding well enough to pass a test. When they do the teaching, that's just not going to cut it. They started to ask more questions and dig for a deeper understanding."

The roles also produced a profound personal effect on students. "Even a struggling high school student could be an expert to the younger group. And the elementary children had heroes to look up to right in their own school," Lyon recalled. "When the little kids put their hands into those of the older students, even big, strong football players were humbled. They saw each other in a different light in the classroom."

Photo by Nick Waring

Jacqueline Whaley

Implementing the project also affected the teachers in unexpected ways. After watching the students teach, Whaley began to change her own teaching style. She lectured less and participated in more hands-on activities with students, as recommended in the National Science Education Standards.

Watching this process, Lyon became fascinated with factors that influence change in teacher behavior, especially in the sciences. That interest has led her to pursue a doctorate in education, while continuing to teach and coordinate a mentoring program—the latest between female students taking high school chemistry and seven-year-old Brownie Girl Scouts.

Lyon summed up her Fellowship experience: "It really motivated and rejuvenated me. It gave me a fresh perspective on being a teacher." Her high school students gained long-term inspiration as well. Several girls and one boy in the program decided to become teachers. After graduating, the boy enlisted in the Navy with the goal of saving money to go to college in order to become a biology teacher. "That's his dream," Lyon noted with pride.

Study of Body Image Motivates Middle School Girls

Middle-school math teacher Kathleen Robens parlayed adolescent girls' interest in their bodies into an after-school club Girls, Unlimited, focused on math, health, and technology. The weekly club attracted about 20 girls, plus guest friends, for academic pursuits above and beyond the school curriculum. It culminated in team projects examining the issue: Are middle-school girls physically fit?

As part of their research, girls took body measurements and conducted sample surveys on eating preferences among their friends and others. They used graphs to analyze and evaluate their data. The program also drew on resources and expertise from the community surrounding the Rosa Parks Middle School in Rockville, Maryland, a suburb of Washington, DC.

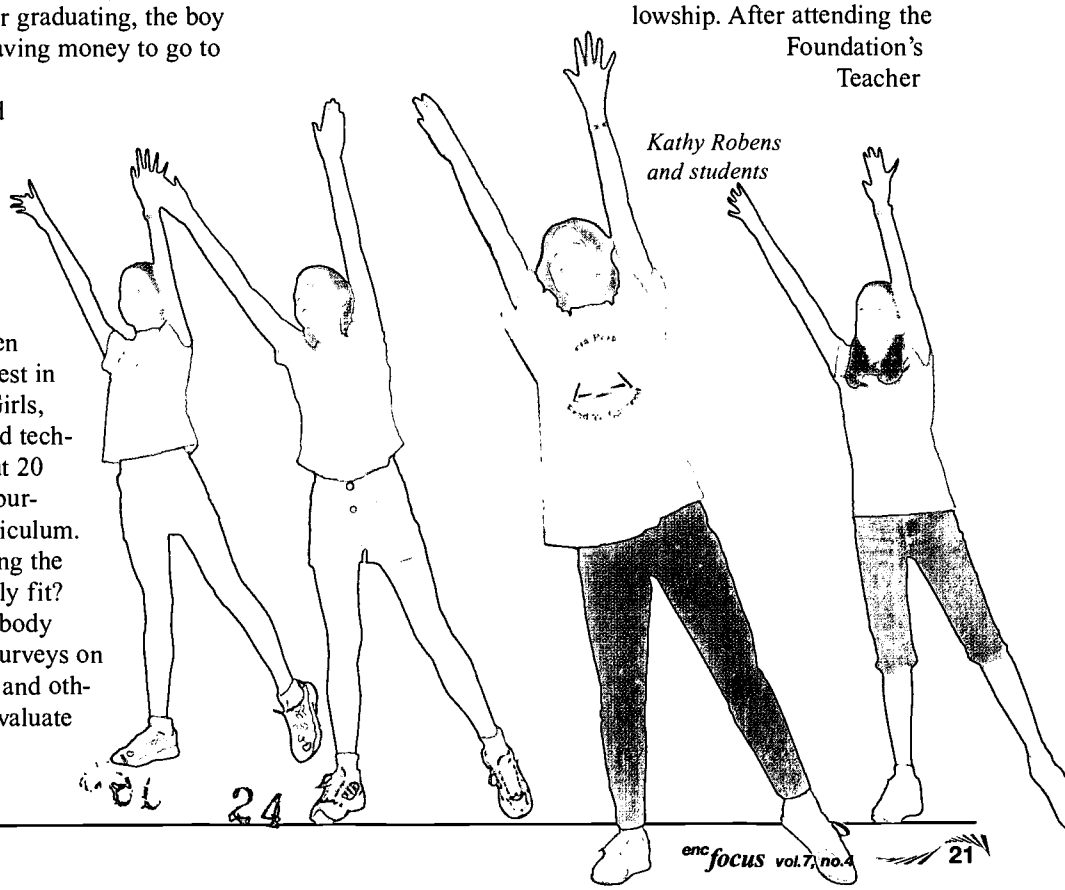
For example, a nutritionist from the US Department of Agriculture demonstrated ways to link food concerns with math, as in understanding the amount of fat absorbed in frying by measuring the surface area of French fries. On a field trip to the University of Maryland, the girls heard a kinesiologist explain how she uses math to study children in motion. The students also learned that science can be fun when they were dunked in a tank to measure the relationship of body fat to mass. They worked out on a treadmill to determine the output of oxygen over time.

By recognizing and capitalizing on the girls' interests, Robens retained about 80 percent of the club's diverse participants, who entered the program with a range of math abilities. "Girls are so focused on how people look—body fat, body image, even whether or not women scientists wear lab coats. That's where they are," Robens acknowledged.

At the same time, her approach to learning succeeded in puncturing the girls' preconceptions about science. "They learned that science can be fun and interesting. They discovered new role models. And I think they saw the value in using math to answer questions," she said.

The program had impact beyond instruction; it also helped the girls to become confident with technology as they surfed the Internet to find information and used graphing calculators or a digital camera in preparing presentations. One mother commented that her daughter gained a greater appreciation for her abilities in math and science while learning the importance of exercise and healthy eating habits.

Robens also gained from her experiences during her fellowship. After attending the Foundation's Teacher



Kathy Robens and students

Institute and hearing about the latest research on girls' learning experience, she explained, "I had never fully realized that girls lose out because they are self-conscious in the classroom. Now I go to help these students more frequently."

Inspired by the NASA women scientists at the Institute, Robens started to take courses at the Space Science Internship Program at Johns Hopkins University. "I feel this is the beginning of more great contributions for girls—and for boys—in school. We're planning related programs next year," she says.

An After-School Club Connects High School Girls and Technology

As a math teacher at Charles H. Milby High School in Houston, Texas, Cynthia Lanius was concerned about the serious underrepresentation of women in computer science. Using funds from an Eleanor Roosevelt Teacher Fellowship, she established a girls' computer club at the predominantly Hispanic school. The club introduced girls to the Internet and to the use of technology as a resource and gateway to future jobs. Called the Women's Technology Council, the club met from 5:30 to 7:30 p.m., after the girls had finished with classes and their after-school jobs. About 20 promising girls, whom Lanius had selected from her classes, attended that year.

More than three years later, the online club still exists (http://math.rice.edu/~lanius/club). Meanwhile Lanius has moved on to teach teachers how to attract girls to the computer science field. Receiving the teacher fellowship, Lanius says, "validated that what I was doing to support girls was right. And meeting others out there doing similar things was a very encouraging part of the experience." She is now co-director of GirlTECH, a teacher training and student technology council program (http://math.rice.edu/~lanius/club/girls.html) at the Center for Excellence and Equity in Education at Rice University in Houston.

The GirlTECH program helps teachers upgrade their technology skills, including building web pages and publishing on the web. At the same time, the program raises teachers' awareness about the lack of girls' participation in computer science—lower even than in physics. Attended by 50 teachers for two weeks in the summer, the classes train teachers in ways to combat the negative trend and help girls become more interested in computer technology.

Cynthia Lanius' work has been frequently recognized in ENC's monthly Digital Dozen award program (enc.org).

Teachers Also Benefit

In each of their fellowship projects, teachers bolstered students' achievement in math, science, and technology by making connections between subject content and students' interests. At the same time, these dedicated teachers gained fresh insights and renewed excitement and pride in their professions.

Each year, the AAUW Educational Foundation renews its goal as a catalyst for gender equity in schools by supporting promising projects like these. To apply for an AAUW Educational Foundation Eleanor Roosevelt Teacher Fellowship or Community Action Grant, call (319) 337-1716, or visit AAUW's website at www.aauw.org. Annual deadlines for applications are January 10 for Teacher Fellowships and February 1 for Community Action Grants.

Janalee Jordan-Meldrum, Program Officer for K-12 and Community Programs, oversees the AAUW Educational Foundation's Eleanor Roosevelt Teacher Fellowships and Community Action Grants programs. She directs the Eleanor Roosevelt Teacher Institute, develops resource tools for classroom and community-based projects, and provides technical assistance to applicants and grantees.

Tina L. Coplan writes and edits publications for the AAUW Educational Foundation.

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Cynthia Lanius with some of her students

CyberSisters Jumpstart Girls' Interest in Math, Science, and Technology

Middle school girls raise their aspirations as a result of one-to-one relationships with women in science.

by Cerise Roth-Vinson, CyberSisters, Eugene, Oregon

When it comes to math, science, and technology, virtually all girls are "at-risk." While many women are making progress in science- and math-related fields, gaps in access to education and skill acquisition in technology fields are continuing to expand (AAUW, 2000). CyberSisters (www.cyber-sisters.org) is an innovative mentoring program pairing middle school girls with university women who are strong role models in science and math. CyberSisters is achieving success by focusing on the hands-on use of technology to promote girls' interests in science and math.

In the report *Shortchanging Girls, Shortchanging America*, the American Association of University Women (AAUW, 1991) identified the relationship between confidence and educational opportunities as critical to girls' success, particularly in science and math:

> Unintentionally, schools collude in the process by systematically cheating girls of classroom attention, by stressing competitive—rather than cooperative—learning, by presenting texts and lessons devoid of women as role models, and by reinforcing negative stereotypes about girls' abilities. Unconsciously, teachers and school counselors also dampen girls' aspirations, particularly in math and science. The survey finds a strong relationship between perceived math and science skills and adolescent self-esteem. Of all the study's indicators, girls' perceptions of their ability in math and science had the strongest relationship to their self-esteem; as girls "learn" that they are not good at these subjects, their sense of self-worth and aspirations for themselves deteriorate.

Studies by the National Science Foundation (1994) found that high school girls are significantly more likely than boys to enroll in clerical and data-entry classes while boys are more likely to enroll in advanced computer science and graphics courses. When participation in higher-level computer and science classes is disaggregated by gender, the low participation of women who choose computer science as a field of study and who are employed in technology-related careers confirms that computer science remains a male dominated world.

CyberSisters participant and her mentor

Working on a science project that I got to choose with my mentor and presenting it in front of an audience has made it easier for me to answer questions in my science and math classes. I feel more motivated to work harder in those areas.

—Eighth grade girl

Through meeting other women in the science field, I have decided that science is definitely a field I will explore when I'm older.

—Seventh grade girl

CyberSisters has been an effective way for me to provide opportunities for girls in my classroom to learn with individual guidance. With the time and attention of an interested adult mentor, my students are much more aware of how to use local museums and computer technology to find information about science and math topics that interest them.

—Seventh and eighth grade science teacher, Agnes Stewart Middle School, Springfield, Oregon

A new AAUW report, *Tech Savy: Educating Girls in the New Computer Age*. (2000) reveals that the problem is becoming even more acute. Among the findings:

- Girls represent only 17 percent of the Computer Science Advanced Placement test takers, and less than one in 10 of those taking the Computer Science "AB" test (the highest computer science test in the College Board's Advanced Placement Program).
- Women make up roughly 20 percent of information technology professionals.
- Women receive less than 28 percent of the computer science bachelor's degrees, down from a high of 37 percent in 1984. Computer science is the only field in which women's participation has actually decreased over time.
- Women make up just 9 percent of the recipients of engineering-related bachelor's degrees.

Strategies for Increasing Girls' Success in Science, Math, and Technology

1. Provide avenues for girls to develop their interests.
2. Allow girls to determine their own strengths.
3. Expose girls to different modes of learning, including hands-on exploration and project-oriented opportunities.
4. Assess girls' computing environment at home and school to ensure equity and access.
5. Engage girls by encouraging collaboration and cooperation.
6. Support women staff members in science, math, and computer education.
7. Help girls connect to female role models who exemplify real situations and career paths.
8. Teach new skills that are applicable to girls' interests, and incorporate their enthusiasm for different science topics into the curriculum.
9. Encourage girls to use their computer skills to be creative and to customize their learning.
10. Provide ways for girls to demonstrate or teach their skills to others.
11. Nominate girls for higher-level classes, opportunities, and leadership.
12. Expect success and achievement from girls in science, math, and computer science.

Collaboration Across Networks

CyberSisters is built upon a collaborative model that actively seeks the involvement of women educators in science, math, and technology to advocate for gender equity in middle schools. School contacts, usually a science or math teacher or technology coordinator, are critical to the program's mission. In addition to serving as a liaison between the girls, parents, and mentors, teachers nominate girls for participation in the program, help them acquire individual email accounts (a requirement of the program), facilitate the mentor/protégé relationship, and monitor students' progress in the program.

Karen Parmelee

Through a multilayered support network and activities that encourage goal setting and follow-through, participating girls are given the opportunity to create and succeed while enjoying a meaningful relationship with an older role model. In many cases, this is the first time these girls have ever felt the powerful effects of being told—and believing—that they can succeed in fields where so few women are represented.

The key component of CyberSisters, and the reason for its success, is the innovative way it capitalizes on the power of the relationship between mentor and protégé. Mentors encourage middle school girls to gain confidence in themselves, to be willing to take appropriate risks, and to enjoy the rewards associated with good decision making. Specially designed program activities assist each girl to develop a positive intellectual identity by learning about college life, building new friendships, and developing a meaningful one-on-one relationship with her mentor.

How CyberSisters Works in Our School

A Student's Perspective

Karen Parmelee is an eighth grade student at Madison Middle School, Eugene, Oregon. She is a participant in CyberSisters and Geogirls, a related club developed by her teacher, Jenine Newman (see her story below).

Here's what she has to say:

CyberSisters and Geogirls help teach you time management. The learning is different because it is not a project that your whole class does and your grade doesn't depend on it.

What I liked best about having Kendall as my mentor was that she was in a field where there aren't a lot of women and she was *succeeding* in that field.

My advice for girls in science, math, and computers is to go out and try different things in each field of work—maybe even volunteer. Also, have fun with each activity in your classes and explore.

I would ask teachers to make sure that girls stay interested in science and math. Have them do projects that are fun yet still require some work. Let them be creative and learn new skills on the computer.

A Teacher's Perspective

Jenine Newman, a math teacher at Madison Middle School, explains her involvement:

I started a girls' club called Geogirls because I have experienced a very real gender gap in the fields of math and technology. Now in our second year, Geogirls is partnering with the CyberSisters program to provide the girls with one-on-one college mentors in science, math, and technology. In addition, we are working on helping girls achieve national and state standards in science and math (www.jenine.org/geogirls/erfn.html or www.cyber-sisters.org/).

Geogirls started as a team for girls in geometry who wanted to work together to learn how to create their own web site. The first year, six enthusiastic girls spent one to two hours each week before or after school learning HTML coding, drawing or creating computer graphics, researching information, writing, and putting it all together in an award-winning web site called Geogirls (www.jenine.org/geogirls).

That site and the one we created the next year, Geogirls 2000 (www.jenine.org/geogirls2000/), not only provide informational content but also include an interactive game where players work through math problems to solve an exciting mystery. Working with technology tools such as scanners, digital cameras, and both IBM and Mac operating systems, the girls explored concepts and vocabulary we were learning in geometry class. They also researched and wrote brief biographies of famous geometers and women from history who were involved in math or technology.

As a result of my students' experiences in CyberSisters and Geogirls, they have become more comfortable and confident on the computer, improving the chance that they will consider math and technology as viable options for their futures. They use the strengths that they already have in a variety of areas to create something entirely new and, along the way, learn technology skills that they will use no matter what career path they choose.

The CyberSisters Project Presentation Night, where girls and mentors highlight their work for the community, allowed my students not only to show their projects but to see some of the fun and innovative ways other girls their age were learning math, science, and technology. The recognition received by the first Geogirls team was outstanding. We won two regional awards and were interviewed several times on the local news.

While it was wonderful to be in the spotlight, this kind of recognition served as a reminder that there are not enough gender equity programs in science, math, and technology. Geogirls and CyberSisters will have truly succeeded when girls using science, math, and technology are no longer newsworthy.

Try out the Geogirls mystery games:

Geogirls 1999, www.jenine.org/geogirls/

Solve math and math history questions to catch the thief of the famous Rhombus Diamond.

Geogirls 2000, www.jenine.org/geogirls2000/game.html

Solve math problems to catch the parallel-line-eating Geomonster.

Projects Spark Interest

Project-based learning provides an informal opportunity for girls to gain critical skills while learning new science and math content. Mentors and protégés are exposed to realistic opportunities in science and math. The pairs tour a university campus, engage in a day of community service with a wildlife rehabilitation center, and learn computer skills through online research, email communication, and project presentations.

When given the opportunity to discover and to explore science, girls in the CyberSisters program often select project topics that focus on animal life cycles, environmental concerns, advocacy for endangered species, microbiology, space exploration, and health science. Projects completed by girls in the CyberSisters program have included:

- A PowerPoint demonstration of the harmful effects of smoking;
- An informational web site on Hepatitis-C;
- A poster-board demonstration of the Leonid Meteor Shower;
- A project experiment analyzing the effects of UV-rays on amphibians;
- A science model on rain shadow effect;
- And many more exciting projects created and presented by middle school girls. See www.cybersisters.org/girls.html for online examples.

In the course of completing their projects, girls also acquire proficiency in a number of advanced software packages including Adobe PageMaker and PhotoShop, Microsoft Publisher, HTML editors, graphing software, scanning, and digital camera use. In addition, girls gain new skills through exposure to their mentors' university resources including advanced laboratory equipment such as electronic microscopes, oscilloscopes, and lasers.

Gender equity in science, math and technology is critical to making schools work for every child. In ten years, our success will be measured by girls' confidence in pursuing academic majors and careers in science, math, and technology. Through mentoring, project-based learning, hands-on activities, after-school clubs, and realistic career exposure, teachers and community educators can ensure that girls are empowered to succeed.

Cerise Roth-Vinson is the Program Director for CyberSisters. She also works in higher education for the University of Oregon as Assistant Director for an instructional technology center.

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The National Science Foundation. (1994). *Women, Minorities, and People with Disabilities in Science and Engineering:* Washington, DC: NSF, 94-333.

Recommended Resources

Books

American Association of University Women (1999). *Gender Gaps: Where Schools Still Fail Our Children.* New York: Marlow.

Patricia Campbell (1992). *Encouraging Girls in Math and Science.* Newton, MA: Women's Educational Equity Act Publishing Center.

Roberta Furger (1998). Does Jane Compute? : *Preserving Our Daughters' Place in the Cyber Revolution.* New York: Warner Books.

Peggy Orenstein (1994). *Schoolgirls: Young Women, Self-Esteem, and the Confidence Gap: How Schools Shortchange Girls.* New York: Doubleday.

Mary Pipher (1995). *Reviving Ophelia: Saving the Selves of Adolescent Girls.* New York: Ballantine Books.

Jo Sanders, Janice Koch & Josephine Urso (1997). *Gender Equity Right from the Start: Instructional Activities for Teacher Educators in Mathematics, Science, and Technology.* Mahwah, NJ: L Erlbaum Associates.

Valerie Wyatt (1993). *The Science Book for Girls and Other Intelligent Beings.* Toronto: Kids Can Press.

Jo Sanders (1994). *Lifting the Barriers: 600 Strategies that REALLY WORK to Increase Girls' Participation in Science, Mathematics and Computers.* Port Washington, NY : Jo Sanders Publications (ERIC Microfilm Document ED-375214).

Web Sites

Encyclopedia of Women's History
www.teleport.com/~megaines/women.html
Great place to learn about women in science.

National Women's History Project
www.nwhp.org/
Resources on women in science, math and technology, historical achievements, and educational materials.

4000 Years of Women and Science
www.astr.ua.edu/4000ws/4000ws.html
Biographies, photographs, and references of women in science.

The Women's Educational Equity Act/WEEA Resource Center
www.edc.org/WomensEquity/index.html
The Women's Educational Equity Act (WEEA) is a US Department of Education program started in 1974, dedicated to

reducing the educational disparity between men and women. The WEEA Equity Resource Center works with schools, community organizations, businesses, and individuals to publish and market gender-fair education products, fight against discrimination based on gender, race, class, language, and disability, and disseminate the latest resources for multicultural gender-fair education.

Center for Gender Equity
www.wri-edu.org/equity/
The goal of the Center for Gender Equity is to promote technology, science, and mathematics as careers and as areas of civic literacy among girls and women, primarily by strengthening the gender equity knowledge and skills of K-12 teachers and teacher-educators.

Technology, Education, Equity
ed1.eng.ohio-state.edu/advancing/equity.html
From Ohio State University College of Education, an extensive list of links to research, initiatives and program on equity in education.

PBS Program/Site: Digital Divide
www.pbs.org/digitaldivide/
Two-hour program, available on video, examines potentially damaging gender stereotypes in classrooms, game software and on the Internet and the subsequent impact these have on middle school girls.

Women of NASA
quest.arc.nasa.gov/women/won-chat.html
Visit this site to find out when the Women of NASA are online and available to chat. Every week a different person answers questions (chat also available in Spanish).

Girls Count
www.girlscount.org/
As a community of adults who care about girls, this site explores strategies to empower and grow resilient girls. When a girl asks you, "Why should I take algebra?" Girls Count can provide you with 92 good answers.

Gender Equity in Education
www.ed.gov/offices/ODS/g-equity.html
The Department of Education provides an extensive list of additional resources on gender equity in education.

Ensuring Equity in Science
www.ncrel.org/sdrs/areas/issues/content/cntareas/science/sc200.htm
From the North Central Regional Educational Laboratory, this comprehensive site includes current research and links to action initiatives as well as tips for teachers to be more responsive to gender inequities in the classroom.

Voices of Girls in Science and Mathematics
www.ael.org/nsf/voices/index.htm
Voices of Girls is a three-year National Science Foundation-funded project to help girls do well and feel confident in science, math, and technology. Take a survey to find out how well your school includes girls' voices.

About CyberSisters

CyberSisters is an educational telementoring program to improve gender equity in science, math, and technology by pairing middle school girls one-on-one with volunteer college women mentors. The program is offered to middle school girls *free of cost.* It is funded by the Willamette Science and Technology Center (WISTEC), a non-profit children's science and technology museum, and the American Association of University Women (AAUW) Educational Foundation, in partnership with local universities, foundations, businesses, and school districts.

Beginning in 2000-2001, CyberSisters will be the first program of its kind to launch a mentoring program online. The CyberSisters Online Program Kit will allow other teachers, educators, learning centers, and non-profit organizations to begin their own science, math, and technology program for girls as a CyberSisters affiliate.

CyberSisters works to achieve the following goals:

1. Increase the number of middle school girls who have experience using computer technology for the purposes of developing hands-on, collaborative projects in science and math.
2. Supplement middle school girls' knowledge of and interest in science and math through partnership with university women mentors who are educated in or practice in these and other technology-related fields.
3. Develop leadership skills and opportunities for middle school girls in their local communities.
4. Significantly expand the number of academic-based women role models in the areas of science, math, and technology.
5. Expand involvement of college women mentors in K-12 educational systems and build awareness of the special development needs of middle school age girls.
6. Promote middle school girls' experiences with university life and open their minds to previously unknown or unimagined educational possibilities.
7. Foster greater community awareness about gender equity, particularly involving girls in science and math, in local educational systems.
8. Bring together appropriate organizations at the national level to begin strategizing about solutions to the gender equity issues that adversely impact young woman who could succeed in science, math and technology careers.

Equity in the Standards-Based Elementary Mathematics Classroom

This educational researcher suggests using student groups and inquiry-based learning in ways that will enhance the success of all students.

by Christina Perez, TERC, Cambridge, Massachusetts

In 1989 the National Council of Teachers of Mathematics (NCTM) articulated the goal of "mathematics for all" in its *Curriculum and Evaluation Standards for School Mathematics*. The underlying purpose was to recognize and eliminate the long-standing disparities in mathematics achievement between boys and girls, between white students and students of color, and between the economically advantaged and disadvantaged. These disparities, which begin early in a child's education, influence the choices available to that child for the rest of his or her life: "Mathematics has become a critical filter for employment and full participation in our society" (NCTM, 1989).

The state of education has certainly changed from what it was in 1989. Nevertheless, the concerns laid out in the Standards still remain a pressing issue for American schools, and educational equity has moved to the forefront in NCTM's new *Principles and Standards for School Mathematics* (2000).

While some of the gaps in mathematics achievement have slowly diminished (e.g., differences in mathematics grades and participation rates between girls and boys in K-12 education have decreased), others remain intractable.

On the 1996 National Assessment on Education Progress (which uses a framework influenced by the NCTM Standards), males outperformed females in grades four, eight, and 12, with more males than females scoring at the Proficient and Advanced levels of achievement. White students were more apt to score at Proficient and Advanced levels than were students of color (with the exception of Asian/Pacific Islander students). In addition, students not eligible for the free/reduced-price lunch program tended to score higher at all three grade levels than their peers who participated in the program (National Center for Education Statistics, 1996).

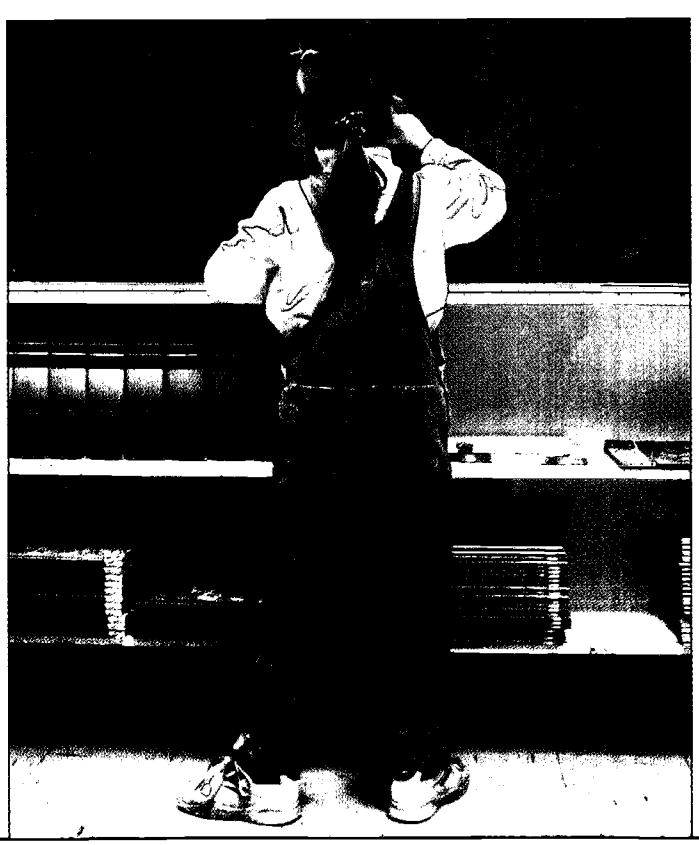
Results from the mathematics portion of the SAT parallel these trends. In 1999 males scored 35 points higher on average than females. White students scored almost 100 points higher than black students and 70 points higher than Hispanic students (College Board, 1999).

The trend continues at the college level. In 1995, despite the fact that women outnumber men in college, only 17 percent of bachelor's degrees in engineering were awarded to women of all races; for math/computer science the total was somewhat higher—35 percent (Campbell and Clewell, 1999). That same year, blacks and Hispanics (at 22 percent of the total US population) only earned a total of 12 percent of all bachelor's degrees in science, mathematics, and engineering (National Science Foundation, 1999).

Inequities Begin in the Primary Grades

The roots of these disparities begin early. By second grade, both boys and girls express gender stereotyping by describing math as a male domain. By third grade, females, in comparison with males, rate their competence in mathematics lower—even when they receive the same or better grades. By sixth grade, girls see mathematics as less important and useful to career goals than boys do (Hanson, 1992).

Teacher practice contributes to the continuation or elimination of these patterns. Some of the most commonly cited research shows that teachers of all grade levels tend to call on boys more often than girls, ask them more complex questions, provide them with more analytical feedback, and attribute their success to ability. Teachers more often think girls



Equity Checklist for the Standards-Based Classroom

Developed by Christina Perez

This checklist can be used as a tool to help you reflect on your classroom practices. No one is expected to check "yes" for all of the items. Think of each item you check "no" as an opportunity to create a more equitable learning environment through reflection and action.

	Yes	Not Sure	No
In your classroom do all students (male, female, different abilities)...			
1. have your encouragement to share their thinking and reasoning about the problems they solve in small groups or with the class as a whole?	❑	❑	❑
2. receive quality and varied feedback (questioning, constructive criticism)?	❑	❑	❑
3. expect to take responsibility within small groups?	❑	❑	❑
4. gain practice trying out invented algorithms as well as conventional strategies for solving problems?	❑	❑	❑
5. have an opportunity to work with manipulatives and other hands-on learning tools?	❑	❑	❑
6. follow established rules for participation (such as calmly raising a hand or waiting to be called on) so that no one student dominates class time and teacher attention?	❑	❑	❑
7. have a chance to use examples and experiences that draw on their own interests?	❑	❑	❑
8. have equal time at the computer and use the computer for mathematical problem-solving (rather than only for practice with isolated skills, such as number facts)?	❑	❑	❑
9. have exposure to math problems grounded in real-life situations that include opportunities to be "messy" (estimation, making predictions, multiple problem-solving methods)?	❑	❑	❑
Do you ...			
1. use language that is inclusive of all kinds of students?	❑	❑	❑
2. provide activities for students to develop those skills, such as spatial skills and higher order problem-solving, that have disparate development in students?	❑	❑	❑
3. allow adequate wait time (3–5 seconds) for students to answer a question?	❑	❑	❑
4. hold high expectations for, and communicate those expectations to, all students?	❑	❑	❑
5. find ways to engage all students in class discussion, even those who are quiet or passive?	❑	❑	❑
6. analyze your interactions with students to check for biased language and stereotyping?	❑	❑	❑
7. try to use software that is free of harmful gender or other stereotypes and that is mathematically rich?	❑	❑	❑
8. encourage girls to be confident in their abilities as mathematicians?	❑	❑	❑
9. encourage girls to pursue math in high school, college, and beyond?	❑	❑	❑
10. structure problem-solving activities so that they are cooperative/collaborative rather than competitive?	❑	❑	❑
11. strive to call on a variety of students, and especially work to involve students who tend not to participate in discussion	❑	❑	❑

succeed in math because they try hard while boys succeed because of their innate ability. The first three patterns also hold true for teachers' interactions with white and nonwhite students (Grayson and Martin, 1997).

Solutions in the Standards-Based Classroom

Standards-based curricula include several teaching methods and mathematical content strands not typically found in traditional elementary math classrooms. Students frequently work in groups. They are encouraged to create their own strategies for solving problems and to be able to use multiple strategies. Data analysis, math of change, and geometry are emphasized.

In the standards-based classroom, the teacher's role shifts from one who gives information to a more facilitative approach. Communication of mathematical concepts through multiple avenues (drawing, graphing, writing journals, dialoguing with peers) is integral. Conceptual understanding is valued more than mere memorization of math facts.

Many of these changes reflect NCTM's commitment to making mathematics accessible to all students. The techniques allow students to learn at their own pace and in their own style, getting at the root of what educational equity is all about. Approaching the classroom with equity in mind means thinking about what each student needs to further his or her mathematical understanding and providing the support for that to happen.

Approaching the classroom with equity in mind means thinking about what each student needs to further his or her mathematical understanding and providing the support for that to happen.

This is very different from the notion of educational equality, which is focused on providing all students with the same thing. Having all students on the same page at the same time fits more closely with the approach of traditional mathematics curricula—and often ends up reaching only those students in the middle. In standards-based classrooms, the teacher as the facilitator of learning has the opportunity to reach all students.

Curriculum alone, though, is not enough to close the gaps in achievement among students. The curriculum provides the supports for the mathematical content, but it is the teacher who must decide how to facilitate the learning of the material. Therefore, there are equity issues specific to standards-based mathematics classroom that teachers should consider.

Learning in Student Groups

In theory, working in groups promotes educational equity by giving each student in the classroom a chance to participate actively. But it is up to the teacher to construct groups that offer a nonthreatening environment for students to explore mathematics. This factor can be particularly beneficial to students who may feel intimidated speaking in front of the whole class.

When organizing student groups, teachers need to consider several criteria. Gender, race, language of origin, problem-solving strategy, and mathematics ability are among the most important. The combination of these factors, along with the added layer of considering children's personalities and other social factors, requires teachers to think carefully about the groupings and to reorganize them frequently to meet students' changing needs.

Rather than always relying on one method for grouping students, teachers should employ a variety of strategies. At times groups should be homogeneous (pairing students of the same ability, language, and gender together); at other times groups should be heterogeneous (placing students of different abilities, races, and gender together).

Having a gender balance in student groups has been shown to be particularly beneficial to girls. One research study demonstrated that in groups of four, if there are three boys and one girl, or three girls and one boy, most of the interactions (questions, problem-solving, hands-on activities) are directed toward boys. The girls in those groups lose out on some of the most substantive mathematics learning. When the groups consisted of two females and two males, the interaction patterns were more evenly distributed (Webb, 1984).

At times placing students of different ability levels together is most appropriate. Students who understand a mathematics problem can help others and at the same time verify their own thinking. In mixed groups, students using invented or alternative algorithms can share their strategies, providing group members with new ways to solve problems. At other times grouping students of similar abilities together is preferred since this enables all students to work at a pace that is comfortable to them.

Similarly, placing students with different language backgrounds together supports both students who understand the math content but struggle with English as well as those who speak English but need more assistance with the mathematics. Alternatively, pairing students who speak the same language allows students to delve deeper into the mathematics without having to also translate language.

Inquiry-Based Learning

Another key component of standards-based curricula is a commitment to inquiry-based learning. Rather than relying on the teacher to tell them how to solve a math problem, students must find their own strategies. This method encourages risk taking, problem solving, and a deeper understanding of mathematical concepts.

Again, the teacher's important task is to consider differences in learning styles and how various styles interact with inquiry-based learning.

For example, one recent research study of first- through third-grade classrooms revealed gender differences in problem-solving strategies for addition and subtraction problems. The teachers in the study were part of a three-year professional development program. Although no specific curriculum was used, students learned standard algorithms and also had an opportunity to invent their own. Results from the study showed that girls tended to use tried-and-true approaches like counting with concrete objects while boys were more apt to use invented algorithms. For subtraction in particular, 80 percent of boys used invented strategies, compared to only 45 percent of girls. A link was also shown between boys' use of invented strategies and their greater success at solving more difficult problems (Fennema et al. 1998).

This study supports the approach of encouraging children to invent their own algorithms by showing how this can lead to higher levels of mathematical thinking (as seen in boys' success rates). But if girls are not using invented strategies, they may not achieve higher levels of learning. Here are a few ways to address this disparity:

1. Look in your own classroom to see if these differences exist. Do girls tend to stick with more basic strategies while boys tend to try new or more complex approaches?
2. Stretch students' thinking by asking them to show multiple ways to solve a problem.
3. Pair students who tend to use invented strategies with those who have a narrower repertoire of approaches. Have each student explain his or her method for solving the problem so that each student can build on the other's thinking.
4. Encourage girls to be confident using multiple strategies. One theory behind the differences in problem-solving strategies posits that girls are taught to play it safe and not take risks, whereas boys are encouraged to step outside the rules. This reliance on what's safe could lock girls into using mostly counting or teacher-taught standard algorithms instead of challenging themselves with alternative strategies. Activities involving estimation, hypothesizing, and multiple ways to solve a problem all support risk taking. By showing girls (and all students) that it's okay to take chances and make mistakes, teachers can promote students' confidence and risk taking.

Built in to the standards-based math curricula are some answers to the question of how to eliminate the achievement gaps in mathematics. But curriculum content alone is not the answer. Varying the composition of groups and attending to students' problem-solving strategies provide two ways to adjust classroom practice to ensure an equitable learning ıment.

Christina Perez is a research and development specialist at TERC. Her work is part of a three-year NSF-funded project (#9714743) titled "Weaving Gender Equity into Math Reform." The project is partnering with several NSF-funded elementary math curricula to expand the equity content of their professional development materials and workshops. This article is based on one appearing in Teacherlink, a network newsletter for Everyday Mathematics teachers. Contact the author at christina_perez@terc.edu

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Teaching in the Language of the Lockup

When we speak about educating every child, do we really mean it? What happens when so-called "at risk" students get into serious trouble?

by Don Deresz, Miami-Dade County, Florida Public Schools

Needing a summer teaching job led me to an eye-opening experience as a science teacher in a correctional facility housing 14- to 18-year-old males. This was not an assignment for the faint of heart. Each cavernous, deafening, two-story unit of 50 cells is the temporary home-schooling site for students who are awaiting trial or prison for crimes such as armed robbery, rape, or murder.

You ain't teachin' us nothin'!

From the beginning, I knew one challenge would be how to engage these students. On the very first day I asked, "What are you most interested in at the moment?"

The unanimous reply was "going home." In response, I promised that our science investigations during the summer would focus on "how to escape."

Working Against the Odds

Even if I could capture and maintain the interest of these students, I knew I faced many other challenges. More than 43 percent of the students in the correctional facility had been labeled as having some sort of learning disability. The school population changed by at least 31 percent during the summer session.

Classes were disrupted by the competing agenda of correctional officers, rehabilitation personnel, medical staff, maintenance crew, food and laundry services, official court visitors, and school district support services. There were also frequent interruptions from fire alarms and the public address system.

In addition, there were numerous obstacles to lesson planning. There wasn't any defined storage space for lab supplies or simple access to utilities such as electricity. Lessons were delivered from a mobile cart, requiring ingenious approaches to laboratory activities. A consistent, echoing ambient noise in the cellblock used as the classroom was annoying to me and to the students.

shoot it

Regulations precluded use of scissors, scalpels, flame, chemicals, and other potentially hazardous materials, and there were serious concerns about the safety of both teacher and students. Officials warned me of past confrontational outbreaks that resulted in severe classroom violence.

Despite these obstacles, I began by establishing clear pedagogical goals for the educational experiences I hoped to provide for these students. For example, I decided to use a cooperative grouping approach that would result in equitable instruction opportunities for this ethnically diverse learning community. Lessons were student-directed and inquiry-based, meeting current science education trends, and alternative assessment techniques were used.

The first task was an assessment of student reading skills through a cloze reading test. I used the results to design materials at the boys' reading levels. They recorded their science experiences in journals to improve their writing and reading skills.

I sought ideas and equipment from other science teachers and teachers of other disciplines. I also found other community organizations and agencies that were willing to collaborate.

Along with all this, I had to recognize a unique student subculture that was antagonistic toward commands but responded well to scholarly endeavors and interesting challenges. Despite the boys' inexperience in doing science, they were able to form a learning community that could engage in properly framed prompts that used connections with their past experiences. Under the right circumstances, these students could think critically, design experiments, analyze acquired data, and communicate in long, narrative responses.

Meeting Their Needs

Using a potpourri of content, learning strategies, and alternative assessment tools grounded in the *National Science Education Standards* (National Research Council, 1996), my students and I explored physics, biology, and chemistry for an exciting 30 days. Each lesson required at least one demonstrable competency by the student, independently or in small groups. I translated lesson objectives into a semblance of sequence, spiraling, and scope.

Some of the boys had previously studied magnets so we used that as a starting point for investigations for our imaginary breakout. Because the cell doors required electromagnets to function, we studied that mechanism, borrowing induction apparatus and a generating bicycle from the local university. We also inquired about properties of electromagnetism using magnetic compasses and different variables

such as coils of wire. Magnetic compasses also helped us find hidden steel bars in the concrete building.

The linear metric system came into play to measure the height of the facility wall and to calculate the number of bedsheets required to get to the top of the wall. Styrofoam cups pierced with holes, filled with water, and dropped from the second-tier balcony demonstrated the force of gravity we would feel if we climbed the wall. Once we imagined ourselves on the other side, we studied how we could use compasses, a map, and the sun's position to help us to find the way home.

quack

Once these learners were hooked, we moved on to other topics. I brought a variety of marine invertebrates from my winter school program so that we could explore their adaptations. We used calculators to do the math and hand-held probes of computer-based laboratory devices to monitor the controlled conditions of our environment, such as temperature and light.

Guest speakers discussed recycling and urban habitat protection programs that portrayed the connectedness of nature. An expert in waste-management was astonished when the students recognized evidence of propaganda, pointing out that recycling was not offered in their low-income neighborhoods, although it was a government responsibility.

This is just one example of the students' critical thinking skills. I found that rephrasing questions and creating discrepant scenarios were well worth the effort on my part because those techniques encouraged the students to engage in inquiry methods and suggest variables to manipulate.

Both formal and informal assessment demonstrated the students' learning. For example, the students successfully transferred their knowledge from their electromagnetic explorations when they listed the components of a generator used in creating electricity from burning refuse. The learning stayed with them, too. I have found that students whom I've instructed in an earlier year at the same correctional facility enthusiastically recalled their learning.

Speaking Their Language

My students spoke in an urban slang that included words such as quack, for disagreeing with a hypothesis as "stupid." Dap me required a gesture of one fist alternating on the top of another fist to signify success. Shoot it meant "give it to me," and Blue became the common name of a jellyfish.

dap me

Although the boys' talk became more familiar to me each day, I did not really speak their language. However, I learned if I took the time to concentrate and to listen, after a while the boys' discourse became as functional to me as it was to them. They were talking science, but in the language of the lockup.

One day, the kids were studying air pressure. A couple of groups took a small bottle, filled it with water, and put an index card on top where the lid usually goes. They then turned the entire apparatus upside down. But some of them did not recite the expected answer mentioning the presence of air pressure. A few, quite independently, thought that the water caused the card to stick to the bottle. I challenged them to prove that. They did. I was (and after research, still am) unable to explain this discrepant event. But, we did discuss molecular adhesive and cohesive forces—in their language.

Frustrations Mixed with Success

I am not saying that teaching imprisoned youngsters was an idyllic experience. I faced many hard truths. I learned that if my summer school students had attended any classes at all in the district system before they were incarcerated, those science classes were very traditional (e.g., do the questions at the end of the chapter, "cookbook" labs, and a lack of critical thinking skills development).

In fact, students began the summer in a zombie-like mental mode. After demanding a traditional science worksheet, one student yelled, "You ain't teachin' us nothin'!"

I had to consider this for a moment and then responded, "You're right! You're the learner. I just set up the surroundings so that you can do the learning. The proof that you're learning is that you demonstrate scientific knowledge by telling it to others—either orally, in pictures, or in writing."

By the end of the summer, many of the students showed an appreciation for our communal and, at times, emotional exploration of science.

Another continuing frustration was the public's attitudes toward educational programs for incarcerated juveniles. I've had many conversations describing my work with these kids, and people appear to abhor the very idea that "juvenile delinquents" should have fun as they are learning science. It is true that some of these boys may be required to go before the court as adults—in name only—for serious felonies involving a victim. Even when I point out that the majority of the students are in a pre-trial situation and have not been found guilty, most people are not swayed from their beliefs.

Blue

Despite these attitudes, I continue to try to make my classes enjoyable and exciting for my summer school students. For these incarcerated youth, the sense of empowerment learning brings is even more important than it is for my public school students. For both I have the same goal—to help them learn how to learn. I especially want the juvenile offenders to realize that they don't need a teacher to be able to learn.

Don Deresz is a science teacher in the Miami-Dade County Public Schools, Florida. The program where he is employed during the regular school year is described at: www.dade.k12.fl.us/usi/cee

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An Equity Dilemma—Teaching Gifted and Talented Students

A challenging and multidimensional classroom is good for all students—including those who are gifted and talented.

by Gay Gordon, ENC Publishing

. . .true equity can only be achieved when we acknowledge individual differences in the students we serve, and when we recognize that high-achieving students have as much right to accommodations in their schooling as do students who are experiencing learning difficulties.

—J.S. Renzulli
Director of the National Research Center
for the Gifted and Talented

Do you recognize the following scenario? You have a class of 30 students, one of whom is extremely bright. Anita immediately understands the concepts you are teaching and is ready to move on while you are still explaining them to the rest of the class. She completes the assignments rapidly, and you know that she can and would do more. Sometimes, she appears bored, sometimes she is occupied with something else (homework for another class?), and sometimes she interrupts the class with questions or her neighbors with comments. You know you are not challenging her, but how can you possibly engage her in a class that is moving much more slowly than she is? Should she be pulled out of your classroom and put in a special class?

Researchers deplore the effects of tracking and special classes for the gifted and talented. They have found ample evidence that all students can do well in mixed classes, but parents often find this hard to believe (Oakes and Lipton, 1990). Some advocates claim that the lack of gifted and talented programs in schools sacrifices "the nation's best and brightest on the altar of political correctness" (Weisman, 1994), but many states and districts do not mandate or fund gifted and talented programs and few offer special services. As a teacher concerned about students like Anita, you know how difficult it is to teach to all the ability levels in your classroom. Without support, how can you make your classroom work for the gifted and talented child?

Recognizing the Gifted Student

J.S. Renzulli, director of the National Research Center for the Gifted and Talented (NRC/GT) at the University of Connecticut, developed a definition based on behavior and results, focusing attention on both motivation and creativity. Renzulli's model (see Figure 1) clearly indicates that there's more to being gifted and talented than a high score on an IQ test. (A full explanation of his model can be found at sp.uconn.edu/~nrcgt/sem/semart04.html).

Among the intellectual characteristics identified with gifted children are precocious language and thought development; early reading and advanced comprehension; logical thinking; early writing, mathematics, music, or art; high motivation and persistence; and compulsion to work hard.

Affective characteristics associated with gifted children include excitability and sensitivity; generally better adjustment than others of the same age; independent and self-motivated learning; desire for flexibility, activity, and a variety of sensory learning opportunities; high degree of internal control; ability to set high goals for themselves; a good sense of humor; and high moral thinking and empathy.

Some gifted and talented children are not identified as such or do not perform up to their ability. Highly creative students are those most likely to be missed in selection for gifted programs because they are not "teacher pleasers." They don't conform and may not do well on IQ tests. Among the traits they do exhibit are high self-confidence, independence, and willingness to take risks; curiosity; humor and playfulness; a need for privacy and time for reflection; attraction to the novel and complex; tolerance for ambiguity; and perceptiveness.

The primary characteristic of gifted students who underachieve in school is low self-esteem. These children are negative about themselves, and they are distrustful, indifferent, unconcerned, and hostile toward others as a result. A secondary set of characteristics is associated with avoidance behavior. They believe that school is irrelevant; they have many excuses for not doing their work; they may be rebellious; they may be perfectionists who set goals too high; and they may have problems with competition. As a result of avoidance, their academic skills may be deficient and they may have developed poor study habits, have poor concentration, and exhibit discipline problems. Because underachievement is learned behavior, it can be unlearned (Davis and Rimm, 1994).

Ideas for Teaching the Gifted and Talented

In an address at the 1999 conference of the National Staff Development Council, Pat Wasley, a researcher at Bank Street College, talked about the need for teachers to add to their repertoire, or the range of skills and activities that help them reach more students. Most teachers have no training in teaching the gifted and talented, but they can learn useful skills in this regard from the math and science standards.

The math and science classroom where hands-on, problem-based learning and alternative forms of assessment are the norm is also a classroom that gives every child, including the gifted and talented, an opportunity to excel. The key to teaching gifted children is providing a supportive, multidi-

mensional classroom environment. Some specific characteristics of such a math and science classroom include:

- Provision of hands-on experience and practical applications.
- Sensitivity to the applications and methods of experiments.
- Use of both qualitative and quantitative data.
- Use of an interdisciplinary approach.
- De-emphasis on competition.
- Provision of a broader, more holistic scope of study.
- Creation of collaborative groups or study groups.
- Creation of communities of learners.

Classrooms in which the gifted do not thrive can be characterized by:

- Lack of respect for the individual.
- Strong competitive climate.
- Emphasis on outside evaluation.
- Inflexibility and rigidity.
- Exaggerated attention to errors and failure.
- "All controlling" teachers.
- Unrewarding curriculum.

Research done at NRC/GT indicated that using pedagogy developed for gifted education programs works very well for all students. The researchers offered an enrichment program (enrichment clusters) to students in two urban schools where many students were poor, had limited English proficiency, and were repeatedly involved in remedial programs. Both the teachers and the students enjoyed the program, and it resulted in the recruiting of many parents and community members to be involved with the schools. The enrichment clusters got everyone excited about learning and were beneficial to the whole school (Reis, Gentry and Park, 1996).

From this research, the Schoolwide Enrichment Model (SEM) emerged. SEM "focuses on applying the know-how of gifted education to a systematic plan for total school improvement." The model is based on the idea of a differentiated learning experience for all children in a school, an experience that takes into consideration each student's abilities, interests, and learning styles. SEM aims "to escalate the level and quality of learning experiences for any and all students capable of manifesting high levels of performance in any and all areas of the curriculum."

Renzulli says that equity does not mean identical learning experiences, but a range of differentiated experiences that take each student's ability into account. To help with such an ambitious undertaking, the NRC/GT has materials and instructions for creating enrichment clusters on its web site (www.gifted.uconn.edu/sempage.html).

Advice for Parents

Just as the advice above for providing a challenging and multidimensional classroom is good for all students, much of the advice for parents of the gifted and talented is good regardless of a child's ability level. For instance, Clark (1988) lists ten things parents can do to support their gifted and talented child and prevent underachievement:

- Provide a stimulating environment at home.
- Establish a close, mutually respectful relationship with your child.
- Become a role model of the behavior you desire in your child.
- Be interested in your child's activities.
- Do not compare siblings.
- Help your child establish time priorities.

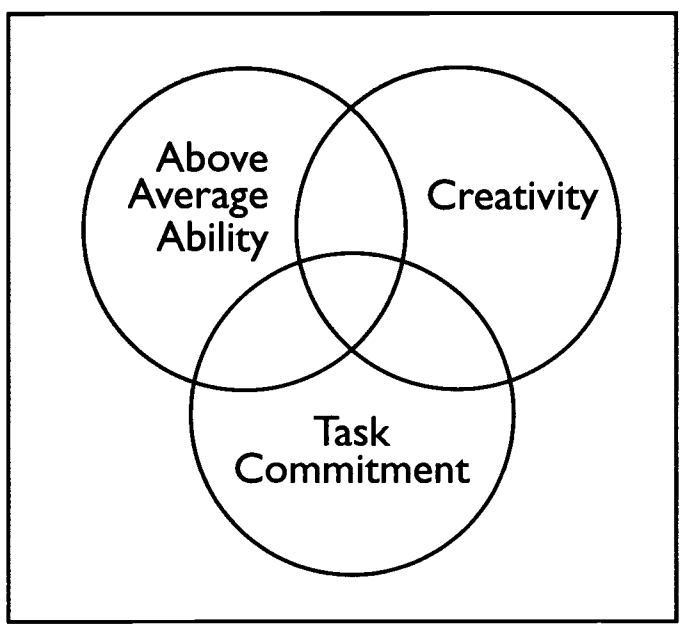

Figure 1. Renzulli's model for identifying the gifted student

- Do not set goals for your child.
- Make your demands and rules reasonable and mutual.
- Show your affection, trust, and approval.
- Support your child and get involved.

Davis and Rimm (1994) add some advice that seems more specific to parents of the gifted. They warn that parents must be careful about the double messages they may be sending to their gifted child, including the message that the child must not look too smart so that he or she won't be thought a "nerd"; that the child's best effort could be better with a little help from the parent; that grades don't count, when they really do; or that winning is everything.

Watching the movie *Searching for Bobby Fischer* is an entertaining and moving way for you or parents to learn more about teaching and parenting the gifted and talented child. The parents in the movie realize that their son is a gifted chess player, and they seek out an established chess teacher to work with him. The teacher is a stern task master who insists the boy practice and play in a certain way and that he stop playing with the men in the park for fun because he is learning bad habits. The boy wins some tournaments, but before long, he does not thrive in this rigid learning environment and begins losing. To find out what happens, you have to see the movie, but I can tell you that it provides powerful insight into both teaching and parenting the gifted child.

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Serving the

Developers of an elementary science program aim to reach all students, regardless of gender, race, ethnicity, language, disability, or socioeconomic status.

by Barbara Sprung and Merle Froschl, Educational Equity Concepts, New York, New York

In a kindergarten, three girls are trying to figure out how to reassemble a food grinder they have taken apart to clean after grinding carrots. Some boys offer to help, but the girls are determined to figure it out for themselves. Once they have it put back together, all their classmates burst into spontaneous applause.

Photo by Jamil Simon, Spectrum Media

Underserved in Elementary Science

- In a first-grade classroom, a boy with cerebral palsy and a girl who is nondisabled are working together to explore "Oobleck," an intriguing substance that is both a solid and a liquid.
- In a self-contained classroom for students who are deaf, students use American Sign Language to describe how water dripped, streamed, and flowed through the sieves they had constructed themselves from recycled aluminum foil pie pans and plastic cups and bowls.
- In a parent workshop, after exploring and making a "mystery bottle" with oil, water, and food coloring, parents generate a list of skills that children would gain from doing the activity. The skills list is translated from English into Spanish, Chinese, Russian, and Burmese, so all parents can understand what their children are learning, and share what they know with other members of their families.

- In an after-school program, ten-year-olds are working cooperatively to do inquiry-based science. They also are keeping journals about science role models who are diverse in terms of race/ethnicity, gender, and disability.

All of the above scenes are real-life examples that show what happens when students from groups that have traditionally been underrepresented in science, mathematics, and technology--all girls, children of color, children with disabilities, and children from low-income families—have access to inquiry-based science education that will help them to meet the standards and prepare for higher level work.

Is it possible to address equity from so many different perspectives—gender, race/ethnicity, disability, and low-income? At Educational Equity Concepts (EEC), we think it is not only possible but absolutely essential if science is to finally shed its image as a white male province for a privileged few.

We created EEC, a nonprofit organization, to develop materials for classrooms and offer training for teachers, administrators, and parents. One of our programs is Playtime is Science. The equity-based parent/child/school activities in the program provide a multi-faceted approach to leveling the playing field for all students. We hope some of the things we have learned will help you think of ways to make your own school more equitable.

Start Early

The astronomer Carl Sagan once pointed out, "Everybody starts out as a scientist. Every child has the scientist's sense of wonder and awe." It is important to build on children's curiosity and provide activities that help them construct knowledge of the physical world.

We recommend activities that combine the scientific process with familiar, real-world materials. This helps children see science as integral to daily life, not as something outside themselves.

Create a Comfort Level for Teachers

If science is to become part of the daily life of the classroom, teachers must become comfortable with hands-on inquiry, messiness, and being able to say, "I don't know. How can we find out?"

Teachers often need help understanding how much science they do know from everyday experiences. We demonstrate that the materials for inquiry-based science can be familiar objects already found in the classroom and that trial and error are a critical part of science learning.

Involve Parents

Many parents feel discomfort about science; they may not have had positive experiences in their own education, or they may feel they don't have adequate knowledge to help their

children. Through parent workshops, we help parents realize that they know more science than they think they do. They learn that they can provide science rich experiences for their children using inexpensive, culturally familiar materials that can be found in their homes—oil, water, beans, and recyclable items such as newspaper and plastic.

Training enables parents to facilitate hands-on activities in the classroom as well as at home. In one school where Playtime is Science was in operation, parent involvement tripled. When asked why there was such a jump, a parent answered, "It's because you trained us as equals in the same workshop with the teachers."

Equity also means making information available to parents in their dominant language. By doing so, you are conveying the message that all parents can be involved in helping their children succeed.

Be Aware of Gender Issues in Science

It is possible that some girls will need coaxing to participate in science activities. Even by kindergarten, boys may have had many more opportunities in problem-solving and developing visual-spatial skills through toys and games that are found in the "boy's" section of toy stores.

Teachers also need to be alert to harmful comments, which may come from both boys and girls, about girls and science. It is important to use resources (books, posters, magazines) that counteract stereotypes. Role models also make a difference. As one fourth-grader commented after a visit from a female biochemist, "If she can be a scientist, so can I!"

Include Students with Disabilities

Students with disabilities, whether they are educated in self-contained or inclusive classrooms, can and should be engaged in inquiry-based science education. The skills in problem-solving, creative-thinking, recognizing spatial relations, observing, and decision-making that are essential for success in science also prepare all students to overcome the challenges they face in daily life.

Often teachers who do not have students with disabilities in their classrooms believe it will be difficult to provide the necessary accommodations. We have found that awareness training plus staff development in hands-on science are helpful. Teachers welcome ideas for creative adaptations that make activities accessible to all students. For example, raising the height of a table may be all that is needed to allow a student in a wheelchair to sit with peers. Or creating easy-grip handles by wrapping them with foam rubber secured by masking tape makes it possible for a student with limited manual dexterity to use tools independently.

Provide Diverse Role Models

If all students are to believe that science education is for them, they need to see diverse women and men in a broad range of jobs and careers in science, math, and technology. Fortunately, there are resources to help create an environment that says, "science is for everyone," and many of them are available free through the National Science Foundation and science-related corporations.

In EEC's science work in schools and after-school settings, we provide resource lists and materials that depict diverse people doing science. We encourage teachers and after-school counselors to bring in women, people of color, and people with disabilities who are in science, math, and technology careers.

Photo by Jamil Simon, Spectrum Media

The Equity Challenge

Since EEC began operations in 1982, we have witnessed much positive change, thanks to the work of the American Association for the Advancement of Science, the Eisenhower National Clearinghouse, the Education Development Center, the Women's Educational Equity Act of the US Department of Education, the National Science Foundation, and countless others who have begun to make the face of science more equitable.

We see signs of success. The 2000 Intel Science Talent Search for outstanding high school science research projects was won by a young woman who could not speak English a few years ago. The Program for Persons with Disabilities and the Program for Gender Equity at the National Science Foundation have supported curricula, hands-on materials, and role model resources that have created pockets of equity in the world of science, math, and technology. And we are proud that our own organization has helped improve the science equity in communities all around the country.

But so much more needs to be done. We have found that most teachers are unaware of the resources for equity that do exist. Preservice teacher education about equity issues in science is minuscule. The atmosphere in many graduate schools in the hard sciences remains hostile to women and people of color. People with disabilities are still largely invisible in the sciences.

The challenge is to build on the work that has been done so every child in school is engaged in inquiry-based science that, in the short-term, helps them enjoy science and prepares them to meet the national standards. In the long-term, such efforts will equip youngsters to become well-informed, scientifically literate adults who are competent to work in the jobs of the future, or, if they so choose, to become scientists.

Barbara Sprung

Merle Froschl

Barbara Sprung and Merle Froschl are Co-Founders and Co-Directors of Educational Equity Concepts, Inc., a national nonprofit organization that promotes bias-free learning through innovative programs and materials. Since 1982, they have been developing curriculum that addresses inequities in traditional science education, including Playtime is Science: An Equity-Based Parent/Child Science Program and What Will Happen If... Young Children and the Scientific Method. Visit the EEC web site at www.edequity.org or email information@edequity.org

Making Technology Work for Every Child

Technology makes a real difference in a high school where every ninth grade student has a laptop computer to take home and to use in every class.

by Patricia Hosken, Redondo Beach, California, Unified School District

Twins Kevin and Jessica are recent immigrants from China. Both are in the ninth grade at Redondo Union High School, both are learning English, and both have received a laptop to use at school and at home as part of the school's Freshman Foundation Program.

"My father, brother, and sister are still in China," says Jessica, "and we use the computer to get to China web sites and see what is happening there." While the laptop is a link to their homeland, it is also a vital part of their educational program in high school.

How the Program Works

Now in its fourth year, the Freshman Foundation Program has garnered much attention as a unique effort to make school work for every child. Every ninth grader receives a wireless/infrared notebook computer, customized to access library resources, the Internet, and electronic learning tools. The computer is intended for use in every learning environment, including the home.

The program creates virtual learning centers, networked in ubiquitous fashion, connecting students and teachers to each other, to their homes, their community, and the world. No student is left out, and therefore, no family is left out.

The transition from middle to high school has long been recognized as a challenging experience for students. Ninth graders themselves cite the expectations for more reading, better research, and numerous deadlines as demanding. We have found that giving each ninth grader a laptop is an effective measure for helping all students to make the transition.

The computers are collected at the end of the year for use with the next group of ninth graders. In their sophomore through senior years, students use other computers at school and many of them use home computers, but they use them more wisely and with greater facility because of the ninth grade experience. Students report that their families save up to buy a computer once they see how important it is for the family and the student.

A natural concern in a program such as this is the issue of loss and damage to the computers. We were amazed—we had less than 1 percent loss/damage last year. We are so pleased with how grateful students are and how responsible they can be.

Changes in the Classroom for Teachers and Students

Technology and instruction work together to make this a successful program for all students. English, mathematics, science, special education, and ESL classrooms, as well as the Cybrary and the Discovery Lab, all have infrared ceiling access points called CAPS. When a student enters a classroom and opens his or her laptop, a connection to a server and the Internet is made through CAPS and the school's backbone network, BeachNet. Using software from NETSchools Corporation (producer of the StudyPro™ laptop), the teacher is able to control all students' laptops.

For example, math teacher Mary White can use the software on her computer to turn off email and Internet access on her students' laptops, thus ensuring that they stay focused on using the graphing calculator. When she is ready for students to use the Internet for data gathering, she gives them immediate access. English teachers frequently turn off the spell-check function when students are working on their spelling skills. And all teachers turn off email when they want to limit the 21st-century version of note passing!

The impact on learning has been significant. Teachers report that writing has definitely improved, and writing proficiency data support this—83 percent of the class passed the first year. Students take advantage of the power of the Internet and curriculum software to create thoughtful products. All students have greater flexibility for working both independently and collaboratively.

The computers also help students with special needs to access more of the core curriculum. Teachers note that students learning English as a second language are able to reach conversational levels more quickly and to move into academic coursework more easily.

Ninth grade teachers are also able to collaborate across disciplines and to communicate with each other regularly. Patty Castles, the program's mentor teacher, has assisted with lunchtime dialog sessions that focus on strengthening the program and dealing with issues of concern.

Teachers value the equality created when each student has access to working online, both individually and with each other. They acknowledge that the Freshman Foundation Program has definitely changed the strategies they use for instruction. The key here is that deep learning and understanding are occurring across the board.

Taking School Home

Almost 60 percent of our students already have a computer at home and are able to continue assignments and complete extra credit assignments with ease. It's the other 40 percent who would be at a disadvantage without the Foundation program.

I received an email from Ryan who said, "I really like having this computer in my house because I can go on the Internet, and I can work on projects at home that I was working on at school." For Ryan and others like him, the laptop is not a luxury, it's a necessity. Students are able to use their home telephone connection to dial into the school server and access their assignments or the Internet. All the while, students are acquiring technology skills to support their progress toward information literacy.

The Freshman Foundation Program is not only an equalizer for students and their families; it also provides an equal basis for teachers. All teachers are given a laptop and training. This has been a key factor in making the program effective and successful.

Teachers consider the laptop their partner in the teaching process. The software allows them to create standards-based lessons, to focus activities on specific curricular topics, and to use the Internet for engaging lessons. Email allows them to communicate effectively and frequently with students and parents.

Shaun Lloyd, an English teacher, has remarked that she likes being able to set midnight deadlines for some projects so that students can take advantage of email to send in completed assignments. She would not be able to do this if all students didn't have a computer at home.

The Freshman Foundation Program has many lofty goals, but one of its highest is to provide access to an effective, technology-based learning environment, anytime, anywhere for all ninth graders. With the skills learned in ninth grade, these students stand a better chance for success in high school and in their careers.

Patricia Hosken has been an educator in Redondo Beach, California, for 31 years; she has taught in the elementary and middle schools and has served as a technology leader for the district for nearly two decades. She also serves on the Eisenhower National Clearinghouse Mathematics Advisory Board, is an active member of the Association of California School Administrators, and is a representative for Los Angeles County to the California Technology Assistance Project. Email her at hosken@bnet.org

Redondo Union High School's Freshman Foundation Program is funded through a one-time technology grant from the state of California and through a Digital High School grant, another state-funded program.

Special Science Teams Focus on Abilities Rather Than Disabilities

A program that fosters collaborations between general classroom teachers and special education teachers leads to better learning for all students.

by Sami Kahn, Rutgers University, New Brunswick, New Jersey

Imagine for a moment that you are a fourth grade teacher returning to school in August. Before you enter your classroom, your principal welcomes you back and indicates that, since you are such an outstanding teacher, three special education students have been "included" in your class. One has a learning disability, another has a visual impairment, and the third has mild cerebral palsy. Your mind races. "I am not a special education teacher!"... "How do I deal with these students?"..."How do I meet their needs, as well as those of the 28 other students?"..."Can a blind child 'do science'?"

Now imagine the converse situation. You are a special education teacher at the same school. On your desk, you see a memo from the principal reminding you that you need to focus on "the standards" this year, particularly since your students will now be required to take the statewide tests. You wonder how you can meet all of these goals, when just keeping your students' attention is a challenge. You are particularly concerned about the new science curriculum, since you were a liberal arts major in college, as most special education teachers were, and feel more comfortable focusing on "the basics" of reading, writing, and math with your students. You wonder, "How do I fit all of these new lessons into one day?"..."Does H stand for Hydrogen or...Help!?"

Collaboration is the Key

The scenarios described above are becoming commonplace as more and more students with disabilities are being included in general education classrooms. According to a report published by the United States Department of Education in 1999, the number of disabled students spending at least 80 percent of their day in regular classes has more than doubled in the last decade, swelling from 1.1 million in 1986 to 2.3 million in 1996.

New regulations, as well as shrinking school budgets, are dictating strict adherence to educating students with disabilities in the "least restrictive environment." In fact, under the newly reformulated Individuals with Disabilities Education Act (IDEA), students with disabilities are now required to participate in the same standardized assessments as the general school population.

While this mainstreaming or inclusion approach offers many benefits for students in terms of socialization and exposure to general curriculum, most general classroom teachers have not been trained in special education and lack strategies and confidence in working with students with special needs. Unless teachers have strategies for helping all students develop social and communication skills as well as ways to foster acceptance of differences by the general population of students, disabled children in mainstream classrooms can experience ostracism and isolation.

Special education teachers have these skills, but general and special education teachers rarely have the opportunity to collaborate closely. Such collaboration becomes crucial in the teaching of science. Inquiry science lessons provide visual and tactile experiences, opportunities for communication with peers, relevance to students' life experiences, and other

All Students Are "Science-Able"

by Sami Kahn

Many of the great scientists in history might have been called "learning or physically disabled" today. Seventeen of the periodic elements were discovered by scientists with disabilities. Galileo was blind during much of his life, and Einstein was thought to be dyslexic. Stephen Hawking, whose movement and speech are severely affected by amyotrophic lateral sclerosis, or Lou Gehrig's disease, is a renowned contemporary physicist. And Temple Grandin, professor of animal science at Colorado State University and the world's foremost authority in the design of humane livestock-handling facilities, is autistic.

Persons with disabilities are sorely underrepresented in science-related fields. While about 20 percent of the American workforce has some form of disability, only 6 percent of the science and engineering workforce has disabilities (NSF, 1996). Lack of exposure to science in school, minimal encouragement, and negative stereotyping all contribute to students' loss of interest and confidence in science (AAAS, 1991).

Even the "equity community" has, until recently, overlooked this problem. Most educational equity programs have sought to overcome educational barriers for persons based on race, gender, language, or socioeconomic status, rather than disability.

For our education system to be effective in preparing all children to be competent in science, teachers must have the skills and confidence to teach science to all children. Most of all, we must view all students as science-able.

attributes that are beneficial and necessary for all students to become successful learners and positive contributors to our society.

The Special Science Teams Approach: SYNERGY!

How can science be taught in a way that meets the needs of all students? At Rutgers University, we have developed an innovative professional development program called Special Science Teams (SST) that incorporates the following components:

- standards-based environmental science curriculum
- equity-based cooperative learning techniques
- disability modifications for hands-on science activities
- support for ongoing collaboration

SST is funded as a model demonstration project in science and disability education by the National Science Foundation and Research for Better Schools. Each summer, 32 teachers from eight New Jersey districts (four from each district—two general education and two special education) are selected to participate in a one-week summer institute at Rutgers University.

During the institute, the teachers model hands-on environmental science activities, with disability modifications, in a cooperative learning format. They simultaneously plan collaborative lessons with their teammates to be implemented when they returned to their schools. Topics include ecology, natural resources and conservation, pollution, classification of living things, and animal adaptations, among many others.

Each activity is aligned with state and national science standards, includes assessments, and has many cross-curricular tie-ins. Moreover, each activity is processed with the participants to address modifications for students with visual, hearing, motor, learning, and emotional disabilities.

All of the activities focus on the use of sensory experiences, such as distinguishing different tree barks by use of touch or identifying the path of a fictitious insect by using scent. For example, to help understand animal classification, teachers develop classification schemes for seashells using the sense of touch, then create animals with specific adaptations, and finally, classify animals using Beanie Babies to illustrate. In each of these activities, there is a tie-in to language arts, math, and social studies.

Encouraging Results

Although only in its second year, the preliminary results of SST have been positive. Participants report they not only feel more comfortable teaching science to students with disabilities but also feel more confident about their teaching of science in general.

Even more exciting, the students love the curriculum and the opportunity to work together. As project director, I often see examples of this. On a recent school visit, two fourth-grade girls, one from the special education class and one from the general education class, stood up together to report on their team findings rather than just the one who had been assigned the reporter role. The girls spoke about pollution in unison. When the teacher asked them why they reported together, the girls replied, "We are a team!"

In another visit, I observed a fifth grade class doing an activity on natural resource conservation using pasta to illustrate the concepts. A neurologically impaired girl who had never been included in a mainstream classroom before said, "This is the most fun I've ever had in school! I'm so happy! Can I come back?" The class applauded.

No Longer Lost

Remember the two teachers at the beginning of this narrative? One was a general education teacher who was "lost" in special education and one was a special education teacher who was "lost" in science. Imagine an ending to the scenario, where the two teachers enter their classroom together, sharing ideas, skills, and talents. And then imagine the children, all participating together. That's the reality of Special Science Teams!

Sami Kahn is an educator and lawyer who serves as Associate Director of the Center for Family Involvement in Schools and Director of the Special Science Teams program at Rutgers University. She has co-authored several nationally recognized teachers' manuals involving science and equity. As the parent of a child with a disability, she has become a strong advocate for disability equity and uses her legal training to educate school administrators, teachers, and parents about rights and responsibilities surrounding disability.

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More information on Special Science Teams can be found on the SST web site at www.rci.rutgers.edu/~cfis/special.htm

Receive information on Science Education for Students with Disabilities (SESD) by contacting the author at samkn@rci.rutgers.edu

Teaching in an Equitable—and Safe—Science Laboratory

Safety is just one of many important concerns when students with special needs enroll in laboratory courses.

by Malcolm S. Cheney, West Hartford, Connecticut, Public Schools and Kenneth R. Roy, Glastonbury, Connecticut, Public Schools

Dangerous chemicals, sharp tools, and breakable glassware make a science laboratory a challenging place to teach adolescents. The challenges are intensified when laboratory classes include students with disabilities. Many science teachers have not been prepared to address the needs of these students. They worry about how to accommodate students with disabilities while still providing inquiry-based lab experiences for all in a safe environment.

The first step for science teachers is to gain knowledge of laws and standards related to special education and laboratory safety. The second is to work in concert with special education teachers, administrators, and parents to plan and to put strategies into operation. We recommend a three-pronged approach that includes instructional modifications, accessible facilities, and administrative support.

Understanding the Laws

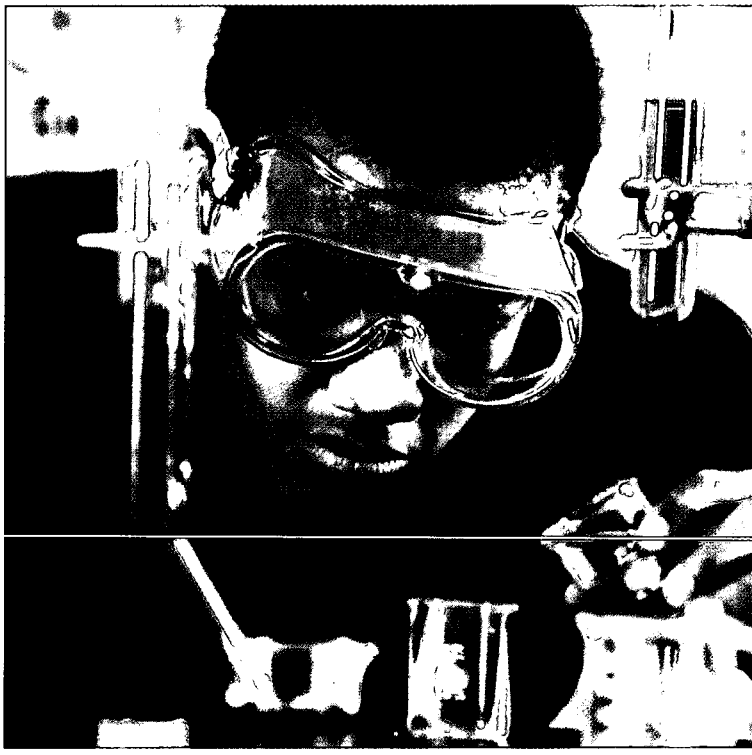
The Individuals with Disabilities Education Act (IDEA)—also known as the PL 105-17 Reauthorization Act of 1997—has increased the mainstreaming of special education students in all classrooms. Science laboratories are included, except where an alternative placement is determined by an Individual Education Program (IEP) or by action of a Planning and Placement Team (PPT).

In addition to special education legislation, another law that affects science laboratory teachers is the Occupational Safety and Health Administration (OSHA) Laboratory Standard (29CFR1910.1450), which was initiated in 1990. The standard requires that school systems design, implement, and enforce a Chemical Hygiene Plan to insure employee safety in a hazardous environment. Although OSHA only protects employees, students usually are required to follow these standards in the science laboratory to maintain a safe environment for all.

When understood by science teachers and school leadership, these two pieces of legislation can be used to promote educational equity and personal safety in the laboratory.

Modifying Instruction

Begin by arranging all students in study buddy or class buddy pairs, combining students of differing or complementary abilities for seatwork and laboratory work activities. It is important to be consistent in assessment and behavioral expectations of all students (except where modifications are specified in an IEP or by the PPT).



Vary instructional methods to compensate for visual and auditory difficulties and provide assistive technology for students having sensory or motor impairments. Remember that learning styles vary from student to student, whether they are disabled or not.

Special education teachers are an excellent resource to help science teachers develop a variety of instructional strategies to better address learning styles and special needs of students. In a class with a large number of special-needs students, the ideal situation is for the science teacher to co-teach with a special education teacher to help insure equal access to the science experience for all students.

Effective classroom management strategies should be employed without fail. As always, it is important for the teacher to take charge of the classroom, providing structure

and posting rules that everyone agrees on and understands. All students respond well to clear schedules and expectations. Simplify instruction and choices for students. Seat problem students in close proximity to where you will be for most of the time and use frequent eye contact. Reward success frequently but honestly.

The web sites listed in the box below provide specific suggestions and resources for ways to modify instruction.

Providing a Safe and Accessible Facility

Classroom doors and aisles must be wide enough (36-inch minimum) to accommodate wheelchairs or persons on crutches. Minimum net-area standards for occupancy loads required by National Fire Protection Association (NFPA) and Building Officials and Code Administrators (BOCA) must be met so that furniture can be arranged around appropriately sized aisles. Be sure to provide barrier-free egress from the laboratory in case of the need for evacuation.

Safety and instructional equipment must be easily accessible. Everything from eyewashes, showers, and fire extinguishers to student lab stations, laboratory sinks, and chalk/marker boards must be low profile. In case of an emergency, access to safety equipment cannot be discriminatory. In these cases, seconds often count.

Provide utility controls (including emergency energy shutoffs) that allow everyone access to water, gas, electricity and so forth. Install safety glass or shatterproof polycarbonate polymer on all room doors, cabinet doors, and windows in the laboratory. Danger from glass injuries can be serious for students and employees.

OSHA Housekeeping standards require the workplace to be free of hazards, such as wires on the floor, that can cause trips or falls. Install computer wiring and other cables appropriately to prevent such hazards. Avoid all use of electrical extension cords.

Administrative Strategies

Two of the most important adaptations—limited class size and special scheduling—will require the involvement of the school principal and other administrators.

Two major factors in determining an appropriate class size are the number of special needs students and the extent of their needs. NFPA Occupancy Load standards require a minimum of 50 net square feet per occupant in science laboratories. Academic professional standards by the National Science Teachers Association (NSTA) set a maximum of 24 students for any laboratory course in science. For safety as well as pedagogical purposes, the NFPA square footage per occupant should be increased and the NSTA maximum number of students in a laboratory should be reduced in a class accommodating students with special needs.

Thoughtful scheduling is another way administrators can make a difference. Lab periods can be scheduled in tandem with special education resource periods, if appropriate. This helps facilitate special PPT requirements, for example, extended test time, special assistance, and other accommodations. Common planning periods for special education and science teachers are essential for co-teaching team members. During these planning periods, the special education teacher can focus on modifications of the lesson plan and the science teacher on modifications for laboratory safety.

Finally, school districts have a responsibility to provide professional development on an ongoing basis. Teachers need help in meeting the needs of all students while maintaining laboratory safety standards.

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Link to these web sites through the online version of this magazine: enc.org/focus/equity

www.as.wvu.edu~scidis

From West Virginia University, this site about teaching science to students with special needs includes teaching strategies for specific disabilities.

www.washington.edu/doit

Do-It at the University of Washington provides workshops and strategies for science teachers and their students.

The Search for Bias-Free Educational Software

Educators can take the lead in insisting on educational software free of cultural and gender bias.

by Carolyn Sue Gardiner, St. Timothy School, Columbus, Ohio

Thirty years ago, my mother wrote her master's thesis on the topic of women's rights. Her then-newly developed attitudes upset a household that mirrored the norm of the day: the father went to work and the mother stayed home and took care of the children. Then I could not have dreamed that I would someday write my master's thesis on a similar topic.

I find it unfortunate that it is still important to discuss equity related to gender and other factors such as ethnicity, but the wealth of new studies on these topics (see the Reference list for just a few samples) shows that these are still controversial issues. If studies like these are needed, then cultural and gender stereotypes are still being perpetuated.

I believe that we have the opportunity as teachers to help our students reject such stereotypes. We must begin by looking at how the materials we use in our classrooms depict different social groups and how these materials affect our students. As part of this mission, we need to scrutinize the design of educational software.

My Journey to Understanding

Until my daughter was born, I did not realize how much I had been influenced by my mother's struggle with her identity as a woman in the 1970s. I told my husband that we should have a balance of toys for Carie. If we bought her a doll, then we were going to buy her a truck as well. We wanted her to grow up with the attitude that she could be anything she wanted to be, and that gender should not be an issue in her decision.

I held this same philosophy when I began my teaching career. This sometimes led to heated classroom discussions with students from traditional households, but as the years passed, these discussions became less frequent. We were seeing a better balance of gender and culture portrayed in our textbooks. I sent interested middle school girls to the Women in Science Conferences held at Ohio State University. The girls in my classes were doing as well as the boys in Science Fair and Odyssey of the Mind competitions.

However, I did not anticipate the impact of the computer in the schools. The boys were drawn to computers like magnets, but the girls seemed intimidated. In fact, so was I.

Three of my brothers went into fields in which computers became an important part of their careers. I was lost!

I knew I had to do something to keep up; I made myself sit down with a computer and learn it. I played with it hour after hour and grew to appreciate all that it could do. I soon realized that the computer could only do what it was programmed to do. It did not matter what I wanted to accomplish. If the programmer did not build certain ideas and knowledge into the computer operating system or into the program I was using, I could not make the computer do what I wanted.

I began to understand that the programmer's attitudes influenced much of what I did with the computer (Provenzo et al, 1999). Since most of the programmers of the eighties and early nineties were white males of Euro-American descent, their biases and stereotyped attitudes were the ones programmed into the technology (Damarin, 1998). Most of the software for school and home use was created with a bias toward the white Euro-centric culture and male interests (Huff and Cooper, 1987).

What Can Teachers Do?

Be Thoughtful when Using Software in the Classroom

I have become convinced that designers of educational materials must consider the needs of teachers and students in the design of their products. I believe that designers should not produce items that have predicted outcomes, but rather

materials that allow the user to take an active role in bringing about outcomes that promote learning. Instructional designers should "create learning resources and learning environments that permit teachers and learners to construct knowledge as they see fit" (Streibel, 1993). When I read that sentence and then think of some of the software available to my students, I have to carefully consider what goals I am trying to reach in my classroom. Then I have to take control and make the software help me reach my goals.

My awareness of the challenge of doing so was heightened when I used the program Decisions, Decisions: Immigration (Tom Snyder). When I first used this software, I just thought about the political issues involved in the simulation, which is based on a mayor running for re-election in a city with a growing immigrant population. The mayor is male, a point I did not even think about until I started my thesis. He does have females on his team of advisors. However, the problems with the simulation go deeper.

The main issue in the mayor's re-election campaign is what to do about the immigrants moving into the city. The first time I used this program, I felt it was a great activity. The second year I used it, I became aware that the choices being made by my students were portraying the immigrants in a negative light. If a group of students made decisions favorable for the immigrants, the mayor either lost the election or much of his support.

It dawned on me that biases were built into the program. Did the designer discuss the possibilities of this program with educators? In fairness to the company, I must point out that an evaluation card is enclosed with the program when it is purchased. The first time I used the program, I gave it glowing reviews! I said that it was a great learning experience for my students because they really got involved in it. I honestly did not think of all the gender and cultural issues that came with the simulation.

I still use the program today, but now I use it in a different way. I encourage students to discuss the biases that are portrayed in the software. We talk about immigration problems, but we also discuss how immigrants contribute positively to the diversity that we should be celebrating.

Be Aware of Problems in Software Used at Home

Simulation programs are used more frequently in schools than video games, which are primarily sold for the home market. Most video games are designed to appeal to boys, and unfortunately many of the games include themes of violence, sex, and racism.

When software manufacturers realized that girls are not interested in games such as these, designers created software that fit their stereotypes of the kind of material that would be attractive to girls. The result was "pink software" (Berselli, 1998). Barbie programs in particular became the designers' answer to the desire to sell to girls. This software perpetuates the gender stereotyping of the tall, thin, beautiful female as being desirable in our society.

Another influence that is present in home and educational software is the Disney series of CD-ROM storybooks, interactive games, and publishing software. These products continue to perpetuate the stereotypes that are associated with that company's movies; the inaccurate portrayal of Native Americans in Pocahontas comes to mind right away.

Insist on Software That Is Free of Bias

Just as we teachers look for textbooks and picture books that are sensitive to cultural and gender equity issues, we must also insist that designers of software address these issues. We should avoid using software that perpetuates gender or cultural stereotypes in our classrooms.

Reading reviews of the software you hope to use is always a good idea. Unfortunately, only a few review sources directly address gender and cultural equity issues. One web site that attempts to identify software that is equitable and educational is associated with the Through the Glass Wall project (www.terc.edu/mathequity/gw/html/gwhome.html).

Because of the lack of review sources, we ourselves must scrutinize the software before we buy it. This is not always easy to do. Order your software from a company that allows a trial period. If the program does not meet your needs and the needs of your students, return it with an explanation.

At the very least, fill out evaluation cards that come with the software or create one of your own to send to the designers. Until we become firm in our insistence that biased software is unacceptable in our classrooms, designers will continue to create products that fill their stereotyped views without considering the needs of our students.

Carolyn Sue Gardiner teaches fifth grade and is the Technology Coordinator at St. Timothy School in Columbus, Ohio. She also serves on ENC's Teacher Advisory Group.

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A Handful, Plus One, of Habitats: Now I Remember!

Even in the constructivist classroom, some facts must be learned. Memory devices are especially helpful for students with learning disabilities.

by Carolyn Cannon Jenkins, Westminster College, Salt Lake City, Utah and Mary M. Banbury, University of New Orleans, New Orleans, Louisiana

To a third grader who cannot remember the number of habitats in the world, "a handful, plus one" triggers recall: five fingers plus one, equals six habitats. While there has been a shift in science teaching away from memorizing facts to constructing concepts, students still need to organize their learning, commit knowledge and skills to memory, and recall prior knowledge and data.

According to the Twentieth Annual Report to Congress on the Implementation of the Individuals with Disabilities Act (IDEA), approximately 55 percent of children (ages 6-11) and 41 percent of adolescents, (ages 12-17) with disabilities are fully included in general education classrooms. We have found that memory devices are particularly helpful in meeting the needs of these students.

We would like to share four techniques for recalling and organizing information that we have used to enhance and facilitate memory for our students with learning disabilities. All four were used in the study of habitats. Each strategy actively involves the students in the learning process, helps them make connections to prior knowledge, and facilitates retrieval.

Mnemonic Techniques

Two memory strategies our students particularly enjoy are the use of acronyms and visual imaging.

Acronyms, words formed from the initial letters of a series of words, not only enhance memory but also stimulate creativity. For example, one student who had difficulty remembering the habitats used the first letter of each of the six habitats to create a nonsense sentence. From the names Polar, Tundra, Desert, Grassland, Forest, and Water, he made the sentence "Paul Taught Delicious Gators For Wages." From this, he drew a mental picture of Paul, dollar signs around his head, teaching alligators to read while licking his lips in anticipation of dinner.

Visual imaging, another mnemonic technique, increases recall for content information. Facts acquired from reading or listening are changed to more familiar and meaningful visual forms. Recent research reports that the human brain has "an amazing ability to construct and retain images" (Banikowski & Mehring, 1999, p. 9).

In our study of habitats, we used visual imaging to teach the characteristics of a tundra. For instance, to remember that a tundra is treeless and inhabited by caribou, we asked the students to visualize a caribou standing on a scale that read, "1 Ton." A small circular drawing of trees with a diagonal line across them, signifying "No Trees, " could be above the caribou's antlers. We encouraged students to create and share their own visual images for remembering characteristics of the other habitats.

Visual Displays

Visual displays are memory-enhancing techniques used to organize and learn science material. Visual displays refer "to a variety of graphic structures from simple time lines to complex matrices; their purpose is to organize information in a manner that makes the information easier to learn" (Crank & Bulgren, 1993, p.140). Examples of graphic displays include concept maps, compare-and-contrast matrices, problem-solving outlines, and directional structures.

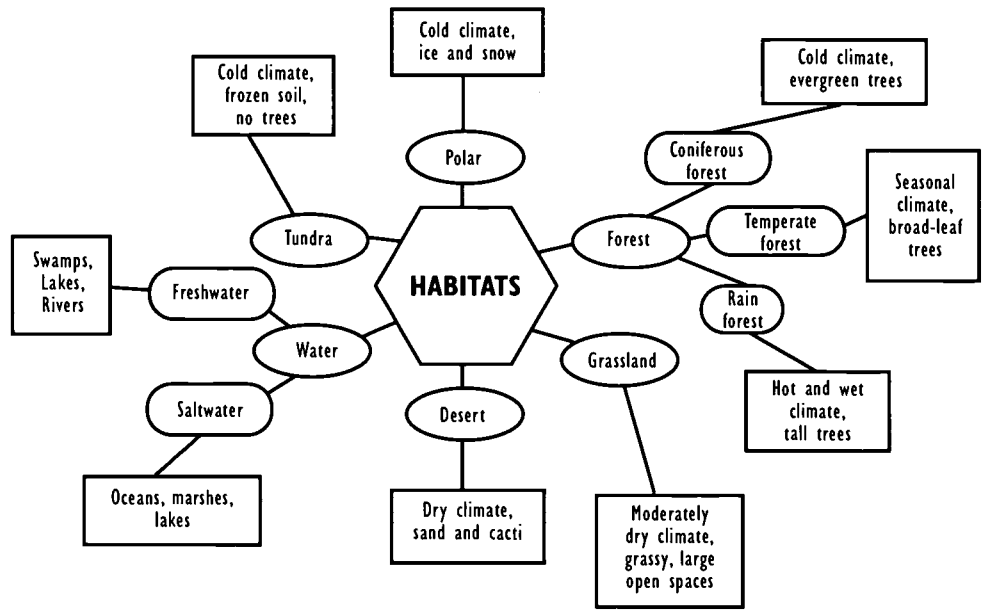

Figure 1. Concept map: six habitats and selected characteristics.

Research on the use of graphic displays with students who have academic problems is sparse but encouraging. Horton, Lovitt and Bergerud (1990) demonstrate that high school students with learning disablities recall more facts from a life science text when information is presented graphically than when it is taught via study guides or self-study. Darch and Carnine (1986) report that elementary-aged students with learning disabilities also perform at a significantly higher level when social studies and science information is presented through visual displays rather than through reading and discussion.

We used two popular and easy-to-use visual displays with our students: concept maps and compare-and-contrast matrices.

Concept mapping is an effective tool for organizing and learning science material. It is a visual illustration of things, processes, or ideas; it is a visual outline. Concept maps consist of main and subordinate ideas. They depict relationships between and among the key concepts as well as link new information to existing knowledge.

For example, the student may see in a single visual display the six habitats along with prominent descriptions. Figure 1 is a concept map of the six habitats and their selected characteristics.

A compare-and-contrast matrix depicts similarities and differences between or among at least two ideas, people, places, events, or things. Bos, Anders, Filip & Jaffe's (1989) research indicates that relationship charts facilitate comprehension and retention of facts and ideas. This type of visual display enables students to observe common themes or concepts. It encourages them to reconceptualize "...science in terms of connected themes rather than disjointed content areas or units of instruction" (Mastropieri & Scruggs, 1994, p. 72).

Our students compared and contrasted plant and animal adaptations and created a matrix, see Figure 2.

HABITATS	Examples of Plant Adaptations			Examples of Animal Adaptations
Tundra	Frozen soil produces small plants			Animals fur thickens and / or changes color in winter
Polar	Cold, harsh climate produces few plants			Animals layer of fat thickens
Forest	Coniferous: short growing season produces evergreen trees	Temperate: four seasons produce trees that lose leaves	Rain: heavy rainfall produces plants that grow quickly	Many animals are camouflaged to blend in with forest
Grassland	Dry climate produces small plants			Animals must run fast because of wide open spaces
Desert	Dry climate produces plants that store water in stems or roots			Animals hunt at night, get water from plants
Water	Water habitat produces plants that adapt their root system to live in water			Animals have gills to breathe underwater

Figure 2. Compare and contrast matrix: two attributes of the six habitats.

More Than Memorizing

Our experiences indicate that memory-enhancing tools provide exciting alternatives to traditional learning methods. Students are not only involved in the learning outcomes, they are actually initiating learning processes. Memory strategies facilitate retrieval of information as well as stimulate comprehension, creativity, and critical thinking.

As the Native American proverb indicates, "Tell me, and I'll forget. Show me, and I'll remember. Involve me, and I'll understand." Students who construct their own learning remember and understand better, increasing their chances for educational equity.

Carolyn Cannon Jenkins has been involved in special education for more than 20 years and science education for the past 10 years. She has taught science at the middle school level and now teaches Science Methods for Elementary Education at Westminster College in Salt Lake City, Utah.

Mary Banbury, a professor at the University of New Orleans, has been teaching for more than 25 years. She was the Principal Investigator for two major environmental education projects: Project CEED (Coastal Education for Economic Development) and Lessons on the Lake: An Educator's Guide to the Pontchartrain Basin.

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Student Grouping That Enhances Learning—and Equity

A nationally certified elementary teacher explains why mathematical content should be strongly considered when students work in groups.

by Hollee Freeman, TERC, Cambridge, Massachusetts

As a former public school teacher in a large urban school district and as a math staff developer providing workshops and consultations across the United States, I have seen a shift in the pedagogy and methodology of teachers and school leaders. In an effort to bring educational reform into their classrooms, many teachers are no longer subscribing to the notion of "every student on the same page at the same time." Instead, they have turned to the exploration of mathematics in groups as a way to distribute learning and peer interaction equitably among all students in the class.

As they meet the challenge of creating a reform-based classroom, many teachers struggle with issues involved in the equitable grouping of students for math instruction. What is equity anyway? How does the notion of "access for all students" fit into mathematics instruction? These questions are particularly complex for teachers facing issues of language diversity and learning differences, as well as the wide range of mathematical experiences and interests that students bring with them to class.

In some classrooms, grouping for math simply means a gender, racial, and/or ability balance of students in a small group working on an activity or problem. There is a good reason for this type of organization. Without specific action to support diverse groupings, some students will indeed choose to work with the peers who are most like them—that is, sharing the same race, language preference, gender, or even socioeconomic characteristics.

With this in mind, heterogeneous grouping of students may seem to promote educational parity. In my own experience, however, I have found that it may not. At times, I believe, students are better served in groups based on shared understanding of mathematical content and strategies or mathematical interest.

Surely, teachers must continue to provide experiences that allow heterogeneous groups of students to work together and share their thinking. However, at other times, I believe that it is important to group students with peers who can best support them in solidifying their understanding of a mathematical concept or discovering new ways of thinking.

Examples from the Classroom

Third Grade

The way grouping can impact mathematical learning was illustrated when students in my third/fourth grade class were working on a multiplication problem:

I went to a furniture store with two of my friends over the weekend. We parked in row number 18 and there were 13 cars in each row. When we came out of the store, we could only see all of the cars in the first 10 rows. How many cars could we see and how many cars were we unable to see in the darkness? Is there a fast way to figure this out?

I gave each student time to work on the problem individually before using groups as a way of sharing strategies and extending their thinking. Students had many different strategies to solve the problem. Some students needed to use unifix cubes or to draw pictures while others were able to solve the problem mentally and to move on to develop extensions for the problem. Some students who were new to the English language were working on explaining their strategies on paper and verbally, while other students were working on finding a place to begin.

In forming small groups, I asked Roberto, a Spanish-speaking student with complex strategies for approaching the problem, to work with Gregory, another Spanish-speaking student. I knew that Gregory would accept help from Roberto largely because of his comfort level with Spanish. Roberto shared his strategy of multiplying by tens and grouping other numbers in a way that was efficient for him. Soon, other Spanish-speaking students joined the group. All the children shared their strategies respectfully. However, only Gregory used manipulatives to find his solution; Roberto and the others used numerical strategies.

Although the other children in the group explained their ideas well, Gregory did not appear to understand all of their thinking. He was still at a point where he needed a concrete representation of the numbers and groupings in the problem. So, I decided that the next day, when we did a different multiplication problem, I would ask him to work with a group whose strategies were more similar to his own, even though these students were not Spanish speakers.

In my classroom, students were always willing to support their peers in this fashion. In many instances, students "slowed down" their thinking and clarified their statements for the benefit of other students who were working hard to understand strategies that were unfamiliar to them at the time. This spirit of community learning is important, but I believe it is also important to allow students opportunities to work with peers pursuing mathematical content closer to their own

level of understanding. In this way, students can receive support that they can "hook onto" and aggressively pursue mathematical thinking that becomes increasingly more complex.

Sixth Grade

I am not suggesting that student groups should always be homogeneously based on experience, confidence, or skills. However, I believe that math groups need to be grounded in the mathematical content that surrounds each math activity and lesson. Groups need to be formed and re-formed so that all students are able to work together to explore and understand the mathematical ideas necessary to work in increasingly more complex ways rather than simply being assigned to a group solely based on their gender, linguistic abilities, or ethnicity.

This strategy is illustrated in a recent mathematics lesson in a sixth grade class at a public school in an urban setting. I asked students to solve this problem:

The captain of a stranded ship is told that there are 4,000 biscuits left. The crew consists of 64 members. Each person gets three biscuits a day. This means 192 biscuits a day for the whole crew. How long will this supply last? (Gravemeijer.)

Students began working on their own as I walked around the room asking questions to help individuals clarify their thinking or figure out where to begin. Two students very quickly calculated their answers using their own invented strategies while the majority of the class rounded numbers, skip counted, and used their knowledge of multiplying by 200. Some students did not know how to begin or were stuck trying to figure out what to do with the remainder.

Using the technique of grouping students who share mathematical strategies and interests, I decided to pair two boys who were separately working on how closely they could calculate the exact time that the crew would run out of biscuits. They were trying to figure out the fractional relationship of days (in minutes) and biscuits. These students were highly motivated to answer this, their own, question. They worked diligently, talking with each other and making connections that involved complex calculations. Other students were not interested in this question or did not even recognize it as a possible extension for the problem.

The mathematical involvement of these two students could have been greatly compromised, as would the thinking of other students, if I had arbitrarily assigned groups based on ethnicity or gender. My role was to allow these students, as well as the other students in the class, the space and time to explore complex mathematical relationships and to clarify their thinking and understanding. Later they would present their ideas to heterogeneous small groups and, finally, defend their thinking in a whole-group discussion.

I continued to support the other students in the class, particularly those who did not know how to start. I asked one small group of girls to work together to come up with ideas about how to proceed rather than accepting the procedure of some of the other students in the class without understanding

Other students were also talking about how to begin working on the problem, but the fact that one group consisted entirely of girls did not seem as important at this particular moment compared to the goal of helping them understand the context of the lesson and to how to develop strategies for solving the problem in a way that made sense to them.

As all students in the class became increasingly more satisfied with their work, they were asked to share their strategies with peers who had solved the problem in different ways. During this time, I was careful to encourage students to work in heterogeneous groups—in this case, girls working with boys.

What It Takes

The notion of forming student groups based on the mathematical content of each lesson presupposes that teachers deeply understand the spectrum of mathematics in each strand of the NCTM standards and are keenly aware of a multitude of teaching strategies. The technique also requires that teachers be adept at questioning, pushing students to search for connections, patterns, and meaning in mathematics. Math work times must be flexible to allow students to pursue their hypotheses and share their work with the entire class while meeting individual and group goals that the teacher has developed.

This is not to say that students with varying interests or with different levels of mathematical confidence or skills should not share their strategies, frustrations, and solutions. However, just as students need numerous opportunities to work in diverse groups, I believe they also need time to work in groups where the mathematics is the driving force.

Hollee Freeman is certified by the National Board for Professional Teaching Standards (NBPTS). Through the NBPTS and The Arts and Entertainment Network (A & E), she has written curriculum materials based on several people featured on that network's televised biography series. She is manager of a NBPTS project that encourages rural teachers and teachers of color to achieve national certification. She is also a Senior Research Associate at TERC, where she works on the project Weaving Gender Equity into Math Reform.

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Proyecto Futuro Brings Science to Bilingual Schools

Teachers report that bilingual students feel valued and motivated when they see materials presented in both English and Spanish.

by Madeleine Correa Zeigler, New Mexico Museum of Natural History and Science, Albuquerque

Funded by the National Science Foundation, *Proyecto Futuro* is an outreach program of the New Mexico Museum of Natural History and Science. The primary purpose of the project is to facilitate hands-on science teaching and learning in the classroom. The program's materials are in both Spanish and English, and this has become just as important as the hands-on aspect for teachers in our area.

Through the program, teachers receive bilingual curriculum manuals for the physical, Earth and space, and life sciences, as well as a science kit of materials to accompany each curriculum. Throughout the school year, a professional development component provides for teacher workshops that focus on hands-on science activities and relate them to grade-level curriculum.

The project also engages parents through bilingual family workshops. Currently, the project involves a number of schools in Albuquerque that have a high percentage of Spanish-speaking or bilingual families.

Adapting the Materials

Longfellow Elementary has incorporated the use of *Proyecto Futuro* bilingual materials into its Dual Language Immersion Program. The school's population includes students who are native English speakers as well as native Spanish speakers. All students are taught in both English and Spanish.

Three teachers from Longfellow Elementary shared how they incorporated the activity New Mexico Volcanoes from the *Proyecto Futuro* Earth and Space Science curriculum into their classroom teaching. In this activity, students create clay models of four different types of volcanoes, locate examples of each on a map of New Mexico, and explode the volcanoes after placing them in the appropriate locations on a large floor map.

Kindergarten

Kindergarten teacher Alicia Searcy explained that she adapted the activity, enlarging the volcano pattern provided in the kit for her students to use to construct paper volcanoes. They then focused on modeling one of the four types of volcanoes, the cinder cone, and used salt dough rather than clay so that they could paint their volcanoes.

They placed the volcanoes in the various areas where they occur throughout New Mexico and watched them explode (with baking soda and vinegar colored with food coloring), observing where the "lava" flowed, and discussed what happens to the land after a volcanic eruption. Searcy used the "New Mexico Volcanoes" activity as a follow-up to a lesson on land formations and how volcanoes form land.

First Grade

First grade teacher Lisa Valdez-Day used New Mexico Volcanoes in her class's study of Earth's interior and how volcanoes form. First she used the *Proyecto Futuro* activity "Earth Building," in which students constructed a flour dough model of Earth showing the internal layers and surface fea-

tures. She chose to do this activity as a whole-group activity to get "everyone talking about it and using the same language."

Then, after reading many books about *volcanes y la tierra* (volcanoes and the earth) and watching a film on volcanoes from *Bill Nye the Science Guy*, the class built clay volcanoes. She didn't use the New Mexico map since the focus was on the layers of Earth.

The students drew the different types of volcanoes in their *cuadernos de ciencia* (science notebooks). "Having all the information in Spanish right there along with the English was such a help," commented Valdez-Day. She added that, with some slight changes, "...students were able to follow instructions and had great success."

To round out the unit, the class visited the New Mexico Museum of Natural History and Science and toured the museum's walk-through volcano. They also took a field trip to climb one of Albuquerque's volcanoes.

Second Grade

Second grade teacher Veronica Olguin explained that she enriched the New Mexico Volcanoes activity by using science portfolios, where students synthesized what they did by writing about it. They answered the questions, "What did I learn?" and "What was my procedure?"

Olguin notes, "At the second grade level, we add more writing following the hands-on activities, helping the students to organize their thoughts. There is also an area in the journal where they can draw pictures."

Benefits for Students and Teachers

All three teachers saw the hands-on approach and the availability of the materials in Spanish as the biggest assets of *Proyecto Futuro*. According to Alicia Searcy, "*Proyecto Futuro* activities are so hands-on that children understand better and the concepts are clearer to them, whether they speak English or Spanish."

Lisa Valdez-Day said that with the *Proyecto Futuro* curriculum, her first graders were able to develop and use their reading skills in both languages to incorporate correct science terminology into their discussions, whether they were native Spanish speakers or native English speakers. She was excited to hear them say things like, "*Aquí está el nucleo externo y aquí está el nucleo interno*" (here is the outer core and here is the inner core) upon studying and constructing their model of Earth and its layers. She stated, "The hands-on approach and having materials that include models and diagrams in both languages is really helpful."

Veronica Olguin shared how in the past she would develop a science lesson, spend an evening translating it into Spanish, and then have colleagues check her science vocabulary translations—a long and arduous process.

Lisa Valdez-Day also added that the bilingual science materials allow for everyone to be involved. As Alicia Searcy put it, "*Proyecto Futuro* has made it more equitable for native Spanish-speaking children to learn science by making materials available in their home language."

The teachers further noted that because of the dual language immersion program, the students take pride in the fact that they are able to explain something in both languages. In so many instances, they see their teachers struggling to find sufficient resources in Spanish. According to the teachers, bilingual material makes the students (particularly the native Spanish speakers) know they are valued. They feel encouraged to learn in both languages—and that makes them feel special. They're so excited when they're told, "Look, it's here in English and Spanish for you."

It was very exciting to hear these three dedicated teachers talk about their classroom strategies and successes doing hands-on science in a bilingual setting while interweaving science into the rest of their curriculum. Their enthusiasm came through loud and clear—as did their love and caring for their students.

Madeleine Correa Zeigler is the Educational Development Specialist at the New Mexico Museum of Natural History and Science. She serves as the Principal Investigator and Project Director for Proyecto Futuro-Albuquerque. To learn more about the project, write to her at the New Mexico Museum of Natural History and Science, 1801 Mountain Road NW, Albuquerque, NM 87104, call (505) 841-2857, or send email to mzeigler@nmmnh.state.nm.us

ENC's collection of more than 17,000 educational resources contains many materials in Spanish and other languages The records are easily searchable online (enc.org).

Focus on the Collection

This section presents descriptions of exemplary resources from the ENC Collection selected to illustrate this issue's theme.

Resources for Meeting the Needs of All Learners

by Carol Damian and Terese Herrera,
ENC Instructional Resources

Equitable access to educational opportunities is one of the challenges we face in mathematics and science teaching. Included in our diverse K-12 schools are those students who do not perform well in math and science and those students who need challenges beyond the usual curriculum. We educators strive to reach all students and promote their achievement, but we often struggle with the question of how to make equity a reality in today's classrooms. As a first step toward addressing this issue, we thought it might be useful to ask: What do we mean by equitable access?

To answer this question, we turned to many sources, including the *National Science Education Standards* (1995, National Academy Press) and the *Principles and Standards of School Mathematics* (2000, National Council of Teachers of Mathematics). We found these common threads running through the discussions of what constitutes equitable access to learning:

- expecting high levels of student achievement;
- developing effective methods of support for the student;
- ensuring system-wide support for teachers as related to classroom equity;
- providing students and teachers with the resources they need;
- assuring opportunities for students to study challenging and worthwhile content; and
- using technology appropriately to enhance learning.

Equitable access does not mean that instruction, materials, and conditions should be the same for all learners, but rather that reasonable accommodations be made for special needs.

Whatever the student's unique needs, teachers are pivotal in deciding how to effectively help all students reach their maximum levels of learning. To do this teachers take into account many different aspects of how children learn, how they respond to their surroundings, and what significant learning they bring to class with them.

In this section of *ENC Focus*, we present resources to help you in the ongoing task of creating equitable access to learning in your classroom. We have included exemplary resources for professional development, such as *The Exceptional Child in the Regular Classroom*, which helps parents and administrators as well as teachers understand the needs of special children. Similarly, *Support for Rural Education* provides insight and suggested solutions for reaching all students in remote settings.

Since instructional methods and materials are at the heart of teaching, we include curriculum materials that incorporate strategies for meeting the needs of all students. Teaching strategies shown to work with special-needs students invariably include the following practices:

- Exploratory, discovery, inquiry approaches;
- A learning environment that encourages collaboration and cooperative learning;
- Problem solving that allows many approaches and many solutions;
- Teaching that is sensitive to multiple intelligences, meaning presentation of a topic from several angles—visual, kinesthetic, and auditory.

These strategies, sound for all learning populations, are embedded in a variety of ways in the curriculum materials we've included here. *Basic Genetics, A Human Approach* looks at high school biology from a personal perspective. *Mathematics from Many Cultures* helps students understand that learning is a universal effort.

Finally, we have included a special section for further reading. In this area, we provide additional information such as articles, historic background, and research.

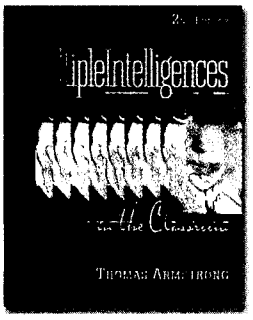
We could not possibly include all of the resources on classroom equity that might be useful for math and science educators. What we have chosen are especially informative materials that we think you may want to investigate. We hope you find these resources inspiring and useful in providing access to learning for every student.

Featured Resources

Professional Development

REACHING ALL STUDENTS

57 Multiple Intelligences in the Classroom (PreK and up)



57 Building Bridges Between Science and Special Education: Inclusion in the Science Classroom (K-12)

57 Collaborating for Change: Including All of Our Students (K-12)

57 The Differentiated Classroom: Responding to the Needs of All Learners (K-12)

58 Equity Is More than Coping with Change (K-12)

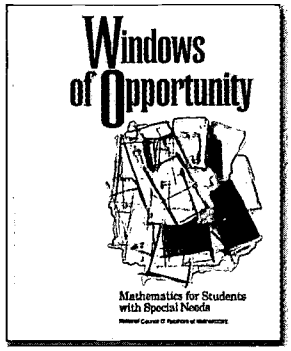
58 The Exceptional Child in the Regular Classroom: An Educator's Guide (K-12)

58 Making Schools Work for Every Child (K-12)

58 Reaching and Teaching All Children: Grassroots Efforts That Work (K-12)

59 Science and Mathematics for All Students (K-12)

59 Windows of Opportunity: Mathematics for Students with Special Needs (K-12)



59 Inclusive High Schools: Learning from Contemporary Classrooms (9-12)

59 The Chemistry Classroom: Formulas for Successful Teaching (9 and up)

MULTICULTURAL APPROACHES

60 Perspectives on Asian Americans and Pacific Islanders (K-8)

60 Creating Culturally Responsive Classrooms (K-12)

60 Cultural Proficiency: A Manual for School Leaders (K-12)

60 Educating Latino Students: A Guide to Successful Practice (K-12)

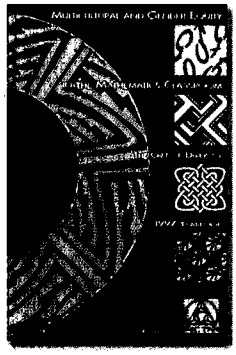
61 Multicultural and Gender Equity in the Mathematics Classroom: The Gift of Diversity (K-12)

61 Multicultural Pavilion: Resources and Dialogues for Educators, Students and Activists (K-12)

61 Native American Students: Including Indians (K-12)

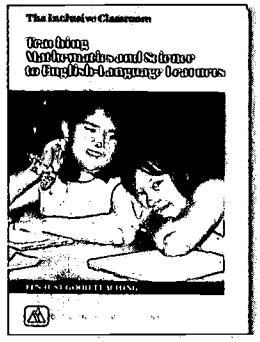
61 We Can't Teach What We Don't Know: White Teachers, Multiracial Schools (K-12)

62 Science: Through Native American Eyes (5-8)



62 Native American Culture Across the Math and Science Curriculum: Multidisciplinary Units of Inclusion (7-12)

LEARNING AND GENDER



62 A Guide to Gender Fair Education in Science and Mathematics (K-12)

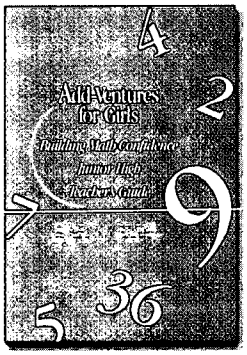
62 Lifting the Barriers: 600 Strategies that Really Work to Increase Girls' Participation in Science, Math and Computers (K-12)

63 Teaching Mathematics Effectively and Equitably to Females (K-12)

63 Weaving Gender Equity into Math Reform (K-12)

63 NSF Program for Women and Girls: A Lifetime of Science, Engineering, and Mathematics (K and up)

63 Rural and Urban Images: Voices of Girls in Science, Mathematics, and Technology (6-8)



63 Add-Ventures for Girls: Building Math Confidence, Junior High Teacher's Guide (7-9)

64 Girls Can Succeed in Science! Antidotes for Science Phobia in Boys and Girls (7-12)

ADDRESSING OTHER SPECIAL NEEDS

64 Challenge: Reaching and Teaching the Gifted Child (K-8)

64 ADD/ADHD Alternatives in the Classroom (K-12)

65 Developing Mathematically Promising Students (K-12)

65 Inclusion in Science Education for Students with Disabilities (K-12)

65 The Inclusive Classroom: Mathematics and Science Instruction for Students with Learning Disabilities (K-12)

65 The Inclusive Classroom: Teaching Mathematics and Science to English-Language Learners (K-12)

65 Support for Rural Education (K-12)

66 Teaching Math to Visually Impaired Students (K-12)

66 Being Deaf (2-6)

TECHNOLOGY AND EQUITY

66 Closing the Equity Gap in Technology Access and Use: A Practical Guide for K-12 Educators (K-12)

66 What Is Computer Equity? A Trainer's Workshop Guide (K-12)

66 Computer Equity in Math and Science: A Trainer's Workshop Guide (K-12)

67 The Technology Connection (K-12)

67 Technology and Students with Special Needs (K-12)

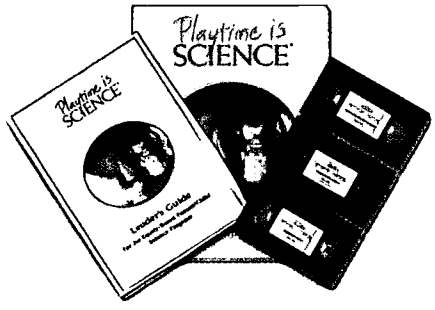
Instructional Materials

SCIENCE

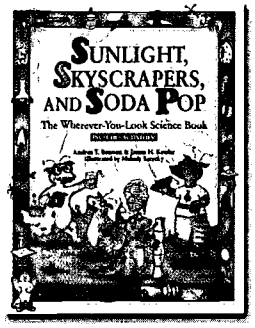
67 Playtime Is Science: An Equity-Based Parent/Child Science Program (PreK-3)

68 Exploring Environments (K-6)

68 MicrobeWorld Activities (K-6)



68 Sunlight, Skyscrapers, and Soda-Pop: The Wherever-You-Look Science Book (K-6)

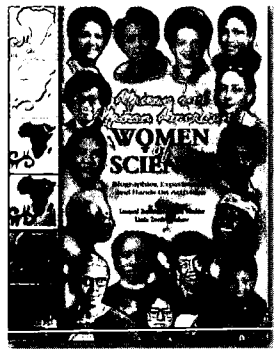


68 Family Science (K-8)

69 The Most Beautiful Roof in the World: Exploring the Rainforest Canopy (3-8)

69 The Scientist Within You, Volume 1: Experiments and Biographies of Distinguished Women in Science (3-8)

69 Science in Early Islamic Cultures (4-7)



69 Spill the Beans and Pass the Peanuts: Legumes (4-7)

70 SPACES (Solving Problems of Access to Careers in Engineering and Science) (4-10)

70 African and African American Women of Science: Biographies, Experiments, and Hands-on Activities (5-12)

70 Science Projects for ALL Students (5-12)

70 Event-Based Science (6-8)

70 What a Find! A Problem-Based Unit (6-8)

71 Basic Genetics: A Human Approach (9-12)

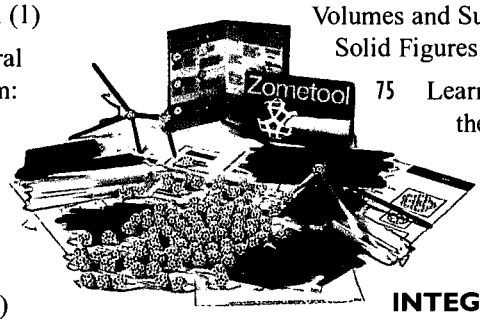
71 Transportation (9-12)

MATHEMATICS

71 Family Math for Young Children—Comparing (K-4)

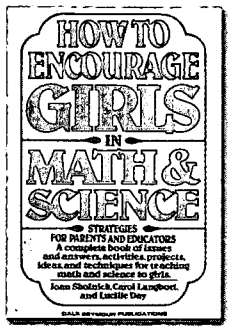
71 Big: Calc (K-5)

72 Access to Math (K-6)



INTEGRATED MATH AND SCIENCE

FOR FURTHER READING



Searching ENC

When you go online to learn more about the materials highlighted here and others, you will find more than one option for searching through ENC's vast collection. Here are a few general tips for making best use of ENC's database of teaching resources.

- The simplest search for curriculum resources on ENC Online allows you to type in any word, and select cost and grade level. Links at this search provide assistance in choosing words.
- The more advanced search options allow you to construct even more specific searches—this is great if you have very clear requirements in mind.
- The materials in this section were carefully selected by ENC's content specialists to fit the theme of this issue. If you would like to see more materials on this topic from ENC's collection, you can create your own search. Hint: To do our initial searches, we used terms such as

  "equal opportunity"

  "gender equity"

  multicultural

  diversity

- The catalog records printed in this part of the magazine contain just the highlights of the full catalog record. To go directly to a specific record, type in the ENC number in the search window of any search option. It is important to type the ENC number exactly as is appears at the end of the item's abstract in this magazine.

Professional Development

Multiple Intelligences in the Classroom

Grade PreK and up
2000
Author: Thomas Armstrong

Ordering Information
Association for Supervision and Curriculum Development
1703 North Beauregard Street
Alexandria, VA 22311
Email: member@ascd.org
(703) 578-9600 / Fax: (703) 575-5400
Toll-free: (800) 933-2723
www.ascd.org

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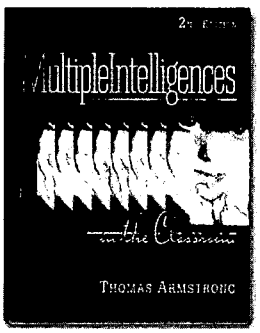
$18.95 for ASCD members



The author of this professional guide describes the theory of multiple intelligences (MI) and its use in the school setting. The author explains that he was attracted to Howard Gardner's model of MI because he wanted to approach special education instruction from the point of view of the students' gifts instead of their deficits. The author's goal is to stimulate educational reform by introducing the practical aspects of the theory of multiple intelligences. This second edition of the book discusses Gardner's eighth intelligence, the naturalist, and his idea for a ninth, called the existential. The book covers various aspects of MI such as the ways that multiple intelligences can be developed within an individual, methods to identify multiple intelligences in adults and children, and ways particular intelligences can be targeted in curriculum and teaching methods. The book suggests changing the classroom environment through the use of activity centers to promote learning with the different intelligences. The guide explains how to gain students' attention and maintain class rules in the seemingly chaotic MI classroom. (Author/GMM/JR) ENC-017258

Building Bridges Between Science and Special Education: Inclusion in the Science Classroom

Series: Electronic Journal of Science Education (EJSE)

Grades K-12
2000
Author: Deborah Haskell
Publisher: College of Education, University of Nevada, Reno

Ordering Information
This article is available free on the Internet at
unr.edu/homepage/crowther/ejse/haskell.html

This article from *The Electronic Journal of Science Education* encourages the collaboration of science teachers with special educators and administrators in the planning of curricula and instruction for inclusion classes. It proposes a four-step plan in which science teachers initiate collaborations with special education teachers to develop instructional strategies that succeed in the science classroom. The plan consists of collaboration between the science and special education teachers, development of effective instructional practices, implementation of lessons with provisions determined by both teachers, and a review of the lessons to make revisions. Some of the recommended instructional practices include the use of graphic organizers, small group activities, and peer tutoring. The article provides examples of a tutor record sheet, a tutor checklist, and a tutee checklist. (Author/JR) ENC-017169

Collaborating for Change: Including All of Our Students

Series: Collaborating for Change

Grades K-12
1996
Author: San Francisco Unified School District

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Paul H. Brookes Publishing Co.
Attn: Customer Service
PO Box 10624
Baltimore, MD 21285
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(410) 337-9580 / Fax: (410) 337-8539
Toll-free: (800) 638-3775

$130.00 per video

In this video, teachers and students from the San Francisco Unified School District are shown discussing issues, concerns, and questions about inclusion. The program explores the differences between inclusion and mainstreaming, the collaborations between teachers in inclusion classrooms and support staff, and the ways that the students work together to learn from each other. Teachers express the feelings they had when they were first approached to have students with special needs in their classrooms. Both the regular education and special education teachers emphasize the need to adjust definitions of success and the importance of giving all students the opportunity to be in a natural learning environment. The students and parents talk about the payoffs in learning, attitudes, and interactions when inclusion takes place. Children with special needs are seen on the playground, in band class, and in drama class. The video mentions that inclusion is a way of meeting federal and state laws requiring schools to give students equal opportunities. The Collaborating for Change video series also includes Instructional Strategies for All Students (ENC-01751), which covers the use of student collaboration to meet individual learning needs. (Author/JR) ENC-017141

The Differentiated Classroom: Responding to the Needs of All Learners

Grades K-12
1999
Author: Carol Ann Tomlinson

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Association for Supervision and Curriculum Development
1703 North Beauregard Street
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www.ascd.org

$21.95 per book (paperback)
$17.95 for ASCD members

This book offers guidance for educators who want to create what the author calls a differentiated classroom, in which teachers develop instruction to address students' individual levels of understanding. The teachers make adjustments so that each student can learn as deeply and quickly as possible to achieve personal triumphs. The book cites educational research and uses real-life examples of teachers and students to illustrate the differentiated learning environment. In a section about instructional strategies, the author describes how stations can be used to meet the needs of each student. For example, in a fourth-grade math class, a teacher set up five learning stations to deal with the students' diverse computational skill levels. Some students had direct instruction on the board while others used manipulatives to explain their work. Other groups practiced computation in the areas in which they needed additional experience or used math applications in a simulated store. The teacher controlled the content and process at each of the stations and varied the operations and the level of difficulty to fit the student's needs. The book explains the what, how, and why of each strategy. (Author/JR) ENC-017107

Equity Is More than Coping with Change

ra.terc.edu/alliance/template/state_connections/nh/nh-equity/toc.html

Grades K-12
1997
Author: editor, Robert McLaughlin
Publisher: TERC, Eisenhower Regional Alliance for Mathematics, Science and Technology Education Reform

Designed for teachers and educational professionals, this online handbook explores diversity issues in the classroom. Originally produced for educators by the New Hampshire State Wide Action Team, the handbook provides resources, information, and thoughtful exercises designed to assist efforts to provide a high-quality mathematics and science education for all students. Emphasis is placed on the importance of this task during a turbulent time of standards-based reform, heightened calls for school accountability, and growing expectations. The handbook includes chapters on educator expectations, classroom practices, and professional development. Several chapters include fictional vignettes that present realistic scenarios in which diversity and equity issues impact student's lives and ability to learn. These vignettes are intended as a catalyst for group discussions and self-exploration of personal subjectivities, attitudes, and experiences. Each chapter includes an extensive list of resources, such as citations for printed publications, primary research, and a wealth of online documents, as well as contact addresses for organizations and individuals. (Author/RJD) ENC-016951

The Exceptional Child in the Regular Classroom: An Educator's Guide

Grades K-12
1997
Author: Lee Brattland Nielsen

Ordering Information
Corwin Press, Inc.
2455 Teller Road
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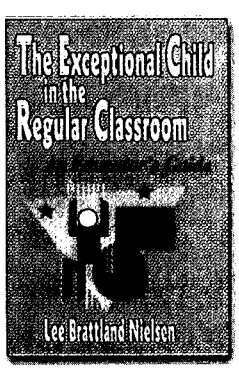

In this book, the author addresses general misinformation about and lack of understanding of children with special needs. The book focuses on students with either physical or mental disabilities, or both. Nielsen outlines the nature and characteristics of the disabilities a teacher is likely to encounter. The book also suggests specific practical strategies educators can use in regular classrooms to promote good learning experiences and productive classroom environments for all students. Major disabilities are arranged alphabetically for quick and easy access to information about specific disabilities. After defining attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD), for example, the guide provides historical perspective as well as pertinent medical information, such as the fact that there is no simple test to detect ADHD. It then lists symptoms for diagnosing ADHD and gives strategies for helping students with this disorder to succeed. (Author/LDR) ENC-008379

Making Schools Work for Every Child

equity.enc.org

Grades K-12
1997
Author: the National Network of Eisenhower Regional Consortia and Clearinghouse (NNERCC)
Publisher: Eisenhower National Clearinghouse

This web site is a resource for educators who are concerned about creating equitable conditions in which every child can succeed at school. The site offers a collection of equity materials related to K-12 math and science education that are designed to help teachers and administrators acknowledge children's diverse strengths, identify inequities, and improve service to students with varied needs. Primary content categories of this site include: Stories and Cases highlighting innovative programs dealing with traditionally underserved populations; Equity Materials providing professional development articles and Internet resources; and Self-Assessment containing checklists and classroom strategies designed to help assess equity in a school. (Author/JRS) ENC-012303

Reaching and Teaching All Children: Grassroots Efforts That Work

Grades K-12
1997
Author: editors, Robert L. Sinclair, Ward J. Ghory

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Corwin Press, Inc.
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(805) 499-9774 / Fax: (800) 417-2466
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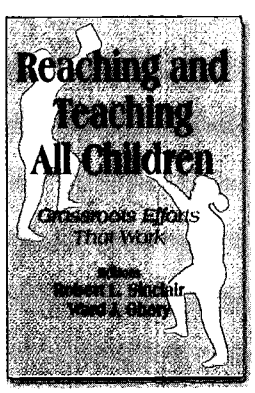
$21.95 per book (paperback)



Described in this book is the five-year grassroots effort by the National Coalition for Equality in Learning to alter the conditions of children's school experiences and to attack problems of inequity in public education. The Coalition considers quality public education to be a moral imperative for a democratic society. This book tells the story of school reform where the focus is on children and their learning, with curriculum and instructional changes growing from the needs of each individual school's unique situation. The material is drawn from experiences in 65 diverse elementary and secondary schools in eight cities where members of the Coalition have helped previously unsuccessful students reach high goals. Suggestions for educators include establishing a climate of trust where students are free of censure or ridicule and involving teachers in study teams to tackle issues related to student learning. It is further suggested that a strong alliance be forged among students, teachers, and parents with the goal of raising the educational expectations for and of every student. Bibliographies are found at the end of each chapter. (Author/JRS) ENC-014819

Science and Mathematics for All Students

Series: It's Just Good Teaching

Grades K-12
1997
Author: Denise Jarrett, Jennifer Stepanek

Ordering Information
Northwest Regional Educational Laboratory Document Reproduction Service
101 SW Main Street, Suite 500
Portland, OR 97204
Email: products@nwrel.org
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www.nwrel.org

$7.65 per book (paperback)
Note: Available free on the Internet at www.nwrel.org/msec/book1pdf.pdf

This booklet, available in print and online, presents an overview of research on the underrepresentation of women and people of color in science and mathematics and describes strategies to increase the interest and participation of all students. Each booklet in the series contains a summary of the research and current literature on a topic along with a discussion of effective strategies and an annotated listing of related resources. This booklet discusses core strategies found to be particularly effective for girls and students of diverse cultural and language backgrounds. Suggested strategies include having high expectations for all students; providing a welcoming classroom environment; using teaching strategies that respond to the needs of diverse learners; and helping students make connections between new ideas and their personal experiences. Featured is the story of a mathematics specialist involved in the implementation of a variety of programs and after-school activities designed to help struggling students reach their potential. Other programs are described. (Author/JRS) ENC-016609

Windows of Opportunity: Mathematics for Students with Special Needs

Grades K-12
1994
Author: editors, Carol A. Thornton, Nancy S. Bley

Ordering Information
National Council of Teachers of Mathematics, Inc.
1906 Association Drive
Reston, VA 20191
Email: orders@nctm.org
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www.nctm.org

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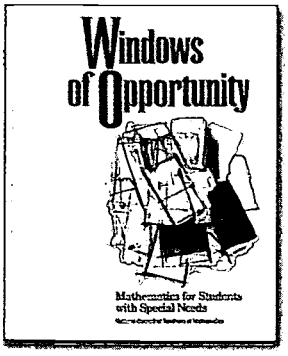

The mathematics and special educators who collaborated to write this professional resource voice concerns, face critical issues, and share ideas for bringing the NCTM vision expressed in *Curriculum and Evaluation Standards for School Mathematics* (1989) and *Professional Standards for Teaching Mathematics* (1991) to reality for students with special needs. A particular focus is nurturing the abilities of these students to think mathematically through problem-centered instruction. The book consists of three main sections. Part one addresses current issues related to high-quality, equitable school mathematics programs for students with special needs. Part two addresses major curriculum thrusts in mathematics. Part three presents several existing mathematics programs that include or are designed for students with special needs. A fourth section details major obstacles to change. (Author/KFR) ENC-008052

Inclusive High Schools: Learning from Contemporary Classrooms

Grades 9-12
1999
Author: Douglas Fisher, Caren Sax, and Ian Pumpian

Ordering Information
Paul H. Brookes Publishing Co.
Attn: Customer Service
PO Box 10624
Baltimore, MD 21285
Email: custserv@brookespublishing.com
(410) 337-9580 / Fax: (410) 337-8539
Toll-free: (800) 638-3775

$26.00 per book (paperback)

Written for teachers, administrators, students, and parents, this resource book provides a framework for developing inclusive high schools, schools that support and offer services to all students. The book features detailed accounts of high schools that have struggled, strategized, and ultimately achieved inclusion. The book includes the stories of students involved in the creation of these new school environments. Both the processes and outcomes that need to be achieved for the inclusive high school are explored. Themes discussed include building school-based relationships, planning lessons and adapting curricula, and redistributing school resources. In the foreword, the reader meets two friends, Aaron and Wilson, one a student council president and the other a multiple handicapped, gifted wheelchair-bound person with a speech impediment. The friends tell, in their own words, how their friendship developed as the result of being transfer students to an inclusive high school and how this friendship affected a senior-year trip to Washington, DC. The foreword highlights attitudes and actions that are roadblocks to the acceptance and inclusion of people who are different and offers a unique view of the possibilities to be achieved in an inclusive high school. These themes of knowledge, exposure, and acceptance of others are expanded and developed in the chapters that follow. Each chapter is written by an educator with first-hand experiences dealing with the changes that must be made in order to create an inclusive high school. (Author/JRS) ENC-016915

The Chemistry Classroom: Formulas for Successful Teaching

Grade 9 and up
1996
Author: J. Dudley Herron

Ordering Information
American Chemical Society
Department 1195
1155 16th Street, NW
Washington, DC 20036
(800) 209-0423 / Fax: (202) 872-6067
www.acs.org/edresources.html

$36.95 per book (paperback)

The author of this book draws on his experience as a chemistry teacher to help science teachers better understand how their students learn. The research cited in the book is meant to help educators analyze their own philosophy of learning. The author shares his thinking about the causes of success and failure in student learning with the hope that readers will reflect upon the same questions regarding their own experiences. The book is divided into four main sections: background description of students, understanding, and principles of learning; theories about student learning and their implications for teaching; specific suggestions to improve chemistry teaching methods; and factors in the students' affective domains that contribute to their learning. Examples and problems are provided to help the readers identify their thought processes as both a teacher and a student. Case studies are used to illustrate students' learning experiences during a chemistry course and their interactions with the teacher. Readers are told to record their thought processes and insights as they progress through the exercises in the book. The author connects the problems in student learning to teaching and assessing scientific concepts, communication, and process skills. (Author/JR) ENC-016302

Perspectives on Asian Americans and Pacific Islanders

Series: Changing the Faces of Mathematics

Grades K-8
1999
Author: editor, Carol A. Edwards

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1906 Association Drive
Reston, VA 20191
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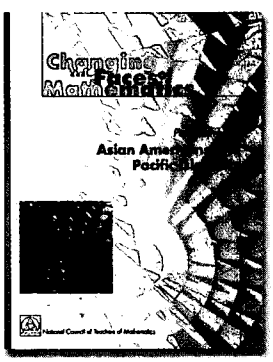

The eight articles in this book address the teaching of mathematics to Asian American and Pacific Island children and the roles of language and culture in the classroom. The series, developed by a task force of the National Council of Teachers of Mathematics, considers varied dimensions of multicultural education and gender in the mathematics classroom. One group of articles in the book focuses on the traditions and contributions of Asian Americans and Pacific Islanders to mathematics by using cultural artifacts and literature to introduce mathematical ideas into the classroom. Another group discusses language and how some Asian children may have been taught to read mathematical notations differently from how most children in the United States are taught. The final group examines cultural differences that may influence classroom dynamics, behavior, and environment. The series also includes *Perspectives on Latinos* (ENC-014850) and *Perspectives on African Americans* (ENC-017142) (Author/JAR) ENC- 016863

Creating Culturally Responsive Classrooms

Series: Psychology in the Classroom: A Series on Applied Educational Psychology

Grades K-12
1997
Author: Barbara J. Shade, Cynthia Kelly, Mary Oberg

Ordering Information
American Psychological Association, Inc.
Book Order Department
750 First St., NE
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Email: order@apa.org
(202) 336-5500 / Fax: (202) 336-5502
Toll-free: (800) 374-2721
www.apa.org

$17.95 per book (paperback)

This book, developed for K-12 teachers, explores the different cultures, learning styles, and styles of behavior of students who are identified as African American, American Indian, Mexican American, and Hmong. The series seeks to integrate theory and practice by having an academic and a practicing teacher coauthor each book. This book is an action guide that helps teachers develop their understanding of individual differences so that they can better engage students in the learning process. The goals of the guide are to provide a knowledge base about the cultural orientations of various ethnic students, to provide suggestions on promoting culturally-attuned motivational strategies and ways to structure culturally responsive classrooms, and to examine the impact of culture on ways of learning. For each topic, the book presents cognitive and educational research findings and specific information about different ethnocultural groups. It also provides opportunities for critical thinking about the issues and ideas as well as practical suggestions for classroom instruction. Self-assessments and bibliographic references are included. (Author/LCT) ENC-011169

Cultural Proficiency: A Manual for School Leaders

Grades K-12
1999
Author: Randall B. Lindsey, Kikanza Nuri Robins, Raymond D. Terrell

Ordering Information
Corwin Press, Inc.
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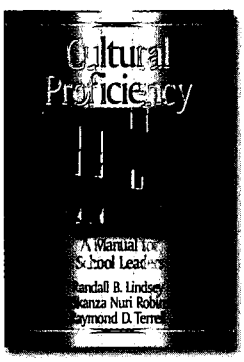

The authors of this book seek to help educators improve interactions with diverse student populations so that all students are treated respectfully and equitably. The book guides readers through an analysis of their schools and themselves as they plan, implement, and assess change. The book contains a cultural proficiency model, which is a framework to facilitate individual and organizational change in policies and practices to develop a positive, culturally diverse environment. Included in this book are guidelines for using the principles of cultural proficiency; a cultural proficiency continuum tool to categorize responses to diversity; performance-based criteria to guide planning; and case studies that illustrate the concepts presented. Historical perspectives are included to help the readers understand the events that have resulted in attitudes and behaviors found in society today. Thirty-nine activities that correspond to the topics discussed in the chapters are found in the resources section. Each activity has a chart that characterizes the activity in terms of the readiness of the group and the expertise of the facilitator. (Author/JR) ENC-015871

Educating Latino Students: A Guide to Successful Practice

Grades K-12
1998
Author: editors, Maria Luisa Gonzalez, Ana Huerta-Macias, Josefina Villamil Tinajero
Publisher: Technomic Publishing Company, Inc.

Ordering Information
Scarecrow Press, Inc.
15200 NBN Away
PO Box 191
Blue Ridge Summit, PA 17214
(747) 794-3802
Fax: (800) 338-4550
Toll-free: (800) 462-6420
www.scarecrowpress.com/crow.html

$44.95 per book (hardcover)

This book is designed to expand readers' knowledge base about quality practices for the education of Latino students. The first half covers administrative and pedagogical practices in elementary grades, while the second half covers the demographics and concerns related to Latino students in middle and secondary levels of schooling. One chapter about supportive learning environments provides the theoretical framework for language, literacy development, and learning to support its assertions about the importance of respect for the students' first language while encouraging the acquisition of the second. The students described in the chapter were studying the animals of the Sonoran Desert as part of their science curriculum. Components of the unit included a web with the students' brainstorming ideas, assessment of the students' prior knowledge, and the collection of information from books, field trips, and interviews with experts. The chapter describes the organization of the students' investigations and offers examples of student work. Reflection and assessment strategies are outlined. (Author/JR) ENC-017191

Multicultural and Gender Equity in the Mathematics Classroom: The Gift of Diversity

NCTM Yearbook

Grades K-12
1997
Author: 1997 yearbook editor, Janet Trentacosta

Ordering Information
National Council of Teachers of Mathematics, Inc.
1906 Association Drive
Reston, VA 20191
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Toll-free: (800) 235-7566
www.nctm.org

$27.00 per book (NCTM members receive a 20% discount.)

In the 1997 edition of the *NCTM Yearbook*, a vision is presented for how research and classroom practices related to multicultural diversity and gender equity can enhance mathematics programs for all students, regardless of their gender, race, ethnicity, or socioeconomic status. The book contains 45 articles that provide a variety of perspectives addressing relevant issues and that offer models for multicultural education. The articles are organized into five sections. Part one introduces general issues and perspectives related to multicultural and gender equity. The papers in part two describe classroom cultures that capitalize on the rich gift of diversity that is available in every classroom. They also provide a look into a variety of classrooms and attempt to show how classrooms can offer mathematically powerful programs for all students. Papers in part three focus on curriculum, instruction, and assessment and how these factors influence equity in the mathematics classroom. Part four addresses some specific professional development activities, including one involving preservice teachers and two others related to increasing family involvement. Part five addresses challenges for the future. Each article includes bibliographical references. (Author) ENC-011153

Multicultural Pavilion: Resources and Dialogues for Educators, Students and Activists

curry.edschool.Virginia.EDU/go/multicultural

Multicultural Pavilion
Resources and Dialogues for Educators, Students, & Activists

Grades K-12
1997
Author: Paul Gorski
Publisher: University of Virginia, Curry School of Education

The resources at this web site address multicultural education and provide a forum for online exchanges about multicultural issues. The site features an article that describes the concept of multicultural education; a Teacher's Corner that provides online resources, including reviews of children's music, multicultural activities, and online literature archives; and a Research and Inquiry department with resources such as statistical data archives, online article archives, and research organizations. Additional departments include classroom discussion activities to heighten multicultural awareness and a collection of online networking strategies, web tutorials, and lists of online forums. (Author/LCT) ENC-011209

Native American Students: Including Indians

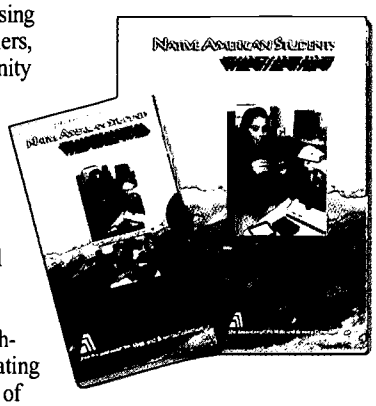
Series: Mathematics and Science for All

Grades K-12
1996
Author: video director and editor, Terry Macy

Ordering Information
Annenberg/Corporation for Public Broadcasting
PO Box 2345
South Burlington, VT 05407
(740) 369-5239 / Fax: (802) 846-1850
Toll-free: (800) 532-7637
www.learner.org

$49.95 per video and guidebook
$134.95 for series library (3 videos and guides)

This video and accompanying resource book are designed to show why mathematics and science education for Native Americans needs to be reformed and how Native American students would benefit from proposed changes. The series consists of three books and three videos that document the collaboration of seven mathematics and science education reform projects in Montana. These projects focus on specific groups of students and/or grade levels: underserved Native Americans, students with special needs, and rural students, but all share the goal of helping all students learn mathematics and science. Addressing issues of interest to parents, teachers, administrators, and other community members, the three programs mentioned in this video are Systemic Teacher Excellence Preparation (STEP), American Indians in Mathematics (AIM), and Minority Apprenticeship Program (MAP). A common goal of these programs is to integrate students' culture and classroom experiences. Suggestions for teaching across cultures include integrating the backgrounds and experiences of students into lessons, utilizing existing American Indian / Alaska Native curricula to enhance learning, and using portfolio assessment to accurately reflect each student's understanding. Changes recommended on this video include implementing cooperative learning in classrooms and recruiting Native American teachers to teach science and mathematics. (Author/LDR) ENC-009981



We Can't Teach What We Don't Know: White Teachers, Multiracial Schools

Multicultural Education

Grades K-12
1999
Author: Gary R. Howard
Publisher: Teachers College Press

Ordering Information
REACH Center
4465 Freemont Avenue, Suite 300
Seattle, WA 98103
Email: reach@nwlink.com
(206) 545-4977 / Fax: (206) 545-6550
www.reachctr.org/

$20.95 per book (paperback)

Author Gary Howard combines personal experiences and research to create a conceptual framework for supporting and promoting the personal transformation of white educators into multiculturally competent people actively involved in social change and transformation. The purpose of the series is to provide preservice and practicing educators, graduate students, and scholars with an interrelated and comprehensive set of books that summarizes and analyzes research, theory, and practice related to the education of diverse groups and to the education of mainstream students about ethnic and cultural diversity. Material in this book traces the author's personal transformation, reviews literature related to social dominance and racism, and presents a transformative vision for white educators. The central unifying goal throughout the book is to encourage and inform white educators in their efforts to become a healing force in the lives of students and a catalyst for change in their communities. (Author/JRS) ENC-017331

Science: Through Native American Eyes

Cradleboard Teaching Project

Grades 5-8
1998
Author: Cradleboard Teaching Project

Ordering Information
The Cradleboard Teaching Project
1191 Kuhio Hwy
Kapaa, HI 96746
Email: order@cradleboard.org
(808) 822-3111
www.cradleboard.org

$75.00 per educator's base kit (CD-ROM and manual)
Call publisher for prices on multiple disc packages.

This CD-ROM is a multimedia interactive tutorial that presents science concepts from a Native American perspective. Cradleboard's founder, Buffy Sainte-Marie, was interested in infusing mainstream classrooms with Native American culture and helped to inspire this product. This tutorial integrates science concepts with concepts from other curricular areas, such as social studies, technology, music, and art. The program allows the teacher to register and track the students in the class as they progress through entry tests, writing activities, and exit tests. Students answer true-and-false or multiple-choice questions as well as short-answer questions that require inem to explain, design, and describe aspects of concepts. The teacher can track the students' progression through the units as well as their performance on the assessments. The tutorial is divided into sections dedicated to sound, friction, and lodge construction. The Native American context provides a real world framework for students to investigate concepts such as the propagation of sound, the principles of friction, and the benefits of architectural components for specific regions of the country. Animations, interactive maps, and simulations supplement the video clips to illustrate the concepts. In the video clips, Buffy Sainte-Marie shows how the science concepts apply in Native American settings. Teacher tips are available in printable PDF files and vocabulary terms are defined with audio pronunciations. (Author/JR) ENC-017262

Native American Culture Across the Math and Science Curriculum: Multidisciplinary Units of Inclusion

Project Future
www.enc.org/reform/journals/enc0113/nf_113.htm

Grades 7-12
1996
Author: editor, Carol Ann Kissam
Publisher: reproduced online by ENC with permission of Project Future, Potsdam College of the State University of New York

Project Future is a program designed to serve talented 7-12 students and to create new math and science curricular materials inclusive of Native American, rural or low-income populations. On the web site, visitors will find curriculum units authored by educational specialists from Potsdam College and several New York school districts. The material is divided into 14 units, developed after intensive summer 1990 and 1991 workshops. The units are varied and encompass many topics, such as ecology, cultures in comparison, nutrition, and writing to learn. The introduction states that the units are intended to use learning styles often attributed to Native American students. The units emphasize active learning and observational skills, Native American issues, supervised participation, and clarification of the practical value of learning as well as the involvement of students in personal mastery rather than competition with peers. Each unit typically includes a unit rationale, several lesson plans, and background information in addition to activity sheets and a bibliography. (RJD) ENC-017245

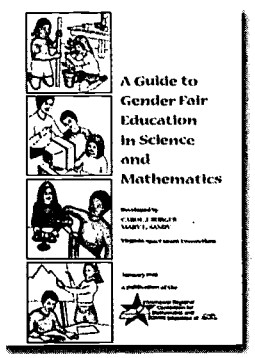
A Guide to Gender Fair Education in Science and Mathematics

Grades K-12
1997
Author: Carol J. Burger, Mary L. Sandy, Virginia Space Grant Consortium
Publisher: Eisenhower Regional Consortium for Mathematics and Science Education at AEL

Ordering Information
AEL Distribution Center
1031 Quarrier Street
PO Box 1348
Charleston, WV 25325
Email: disctr@ael.org
(304) 347-0400 / Fax: (304) 347-0487
Toll-free: (800) 624-9120
www.ael.org/rel/index.htm

$15.00 per book (paperback)

Intended for K-12 educators, teacher educators, and parents, this publication is designed to help readers increase their knowledge and practice of equitable pedagogy. The book cites researchers in the field of educational equity and educators who have found that, depending on a person's gender, race, or ethnicity, there is a difference in the mathematics and science education received. In the publication are samples of programs and activities that can be adapted to diverse situations. Annotated lists of resources expand the readers' understanding of how teaching and learning styles affect students' attitudes toward careers in science. Assessment checklists are included to help pinpoint areas for improvement. The book contains strategies that promote gender equitable classrooms and encourage girls in mathematics and science. These strategies include cooperative learning, patterns of rewards, and career guidance. (Author/JR) ENC- 017094



Lifting the Barriers: 600 Strategies that Really Work to Increase Girls' Participation in Science, Math and Computers

Grades K-12
1994
Author: Jo Sanders

Ordering Information
WEEA Equity Resource Center at EDC
PO Box 1020
Sewickley, PA 15143
Email: EDCorders@abdintl.com
Fax: (412) 741-0609
Toll-free: (800) 793-5076
www.edc.org/WomensEquity

$13.95 per book (paperback)

This book was developed to provide K-12 teachers with teacher-generated and tested strategies for increasing girls' enrollment in courses and girls' participation in extracurricular activities related to mathematics, science, or computers. The book explains the eight principles of gender equity on which the strategies are based. These principles include focusing on the girls, designing activities around their interests, and being careful about language that unintentionally conveys gender stereotypes. Gender equity strategies are incorporated into contests and competitions, clubs, and field trips. Some of the strategies enlist the help of parents to promote gender equity, while others are aimed at changing school or district policies. One strategy, within a section about mentoring, suggests having fourth-grade girls share stories on the computer with kindergarten children. Another strategy, designed to raise awareness, is to invite older women to speak about their experiences with sexism. (Author/JR) ENC-017106

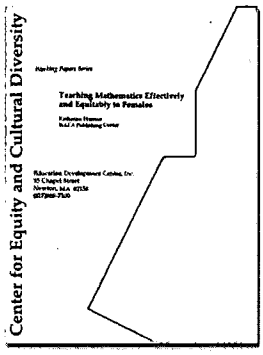
Teaching Mathematics Effectively and Equitably to Females

Series: Center for Equity and Cultural Diversity Working Papers

Grades K-12
1992
Author: Katherine Hanson
Publisher: Education Development Center, Inc.

Ordering Information
WEEA Equity Resource Center at EDC
PO Box 1020
Sewickley, PA 15143
Email: EDCorders@abdintl.com
Fax: (412) 741-0609
Toll-free: (800) 793-5076
www.edc.org/WomensEquity

$6.00 per book (paperback)



Looking at achievement differences in males and females, this professional development book examines equity issues related to teaching mathematics. The author explores the basis for student gender differences and considers how the roots of these differences translate into education issues for teachers. The book is part of a series that features papers designed to challenge existing ideas and promote discussion based on the work of the Center for Equity and Cultural Diversity. In this book, author Hanson considers the common attitudes toward mathematics learning, mathematics course taking, and social expectations based on gender. The discussion moves from current research to practical recommendations for creating an environment that encourages the mathematics development of both females and males. (Author/JRS) ENC-017214

Weaving Gender Equity into Math Reform

www.terc.edu/wge/home.html

Grades K-12
2000
Author: TERC

This web site for staff developers, curriculum writers, and workshop leaders forms part of a project that seeks to expand the equity content of workshops, videos, and written materials for teachers. The project, funded by the National Science Foundation and based at TERC in Cambridge, Massachusetts, is investigating the specific question of gender equity in math reform, as well as the larger equity issues that reform poses for students from various academic, socioeconomic, and linguistic backgrounds. Questions the project is asking include: What are some of the main equity issues for standards-based elementary mathematics curricula? What support do teachers, parents, and administrators need to reflect on and change practices that may negatively affect students of various backgrounds? How can equity issues be successfully connected to curriculum so they are at the forefront of the change process? The site contains equity-related information, including articles such as "An Equity Checklist for the Standards-based Classroom" and "Facing Equity: Facing Ourselves." Also found is the equity challenge question of the month; a recent challenge examines a districtwide assessment question for bias related to socioeconomic status. A link to a discussion of the implications for equity follows the challenges. (Author/JRS) ENC-017235

NSF Program for Women and Girls: A Lifetime of Science, Engineering, and Mathematics

www.edc.org/CCT/pwg/

Grade K and up
2000
Author: Education Development Center, Inc.; Center for Children and Technology

Visitors to this web site can read about some of the National Science Foundation's Programs for Women and Girls (PWG) that promote gender equity in science, engineering, and mathematics. The programs support more than 100 curricular innovations, professional development efforts, and informal learning opportunities for women and girls. The site showcases 12 programs from across the country that have addressed gender equity issues at every developmental stage in women's lives. A searchable directory of fact sheets for all NSF-funded PWG projects contains contact information and brief descriptions as well as links to project web sites where available. One program described on the site, called Playtime is Science PLUS, is an equity-based science program for after-school centers that cater to six- to twelve-year-old children and their families. Another program discussed on the site helps Girl Scout leaders become confident in their abilities to facilitate science, mathematics, and engineering activities with their troops. (Author/JR) ENC-017201

Rural and Urban Images: Voices of Girls in Science, Mathematics, and Technology

www.ael.org/nsf/voices/index.htm

Grades 6-8
2000
Author: AEL (Appalachia Educational Laboratory)

Highlighted on this web site are hands-on activities and programs designed to help girls do well and feel confident in science, math, and technology use. The Voices of Girls project was sponsored by the Appalachia Educational Laboratory (AEL) in Charleston, West Virginia and local county school districts. It was based on the belief that girls are as capable as boys but do not participate as fully as boys in these subjects. The project aimed to help girls, beginning in the sixth grade, discover the science and mathematics in everyday life through meaningful activities. Other features of the project included mentoring by female professionals and involving the participants in helping to teach younger students. The project's activities and methods have been adapted for classroom use and are available to teachers and others from this web site. This site is divided into four sections. The section titled UnCommon Knowledge contains all materials, in PDF format, for workshop activities exploring science, mathematics, and technology topics in the context of Appalachian culture. The other sections of the site offer research papers exploring the role of ethnicity, gender, and social class; a unit titled Granny Did What? for researching folk remedies and medicine; and two examples of school surveys looking into student attitudes and beliefs. (Author/JRS) ENC-017202

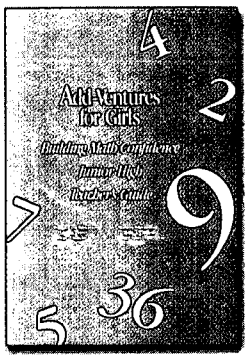
Add-Ventures for Girls: Building Math Confidence, Junior High Teacher's Guide

Grades 7-9
1990
Author: Research and Educational Planning Center, University of Nevada
Publisher: WEEA Publishing Center

Ordering Information
Education Development Center, Inc.
PO Box 1020
Sewickley PA 15143
Toll-free: (800) 793-5076
www.edc.org

$42.00 per book

This book describes attitudes, self-perceptions, and feelings that can deter girls and young women from achieving in mathematics. The book is designed to reverse negative patterns and build girls' positive attitudes and skills in mathematics. Each chapter in the guide begins with a discussion of research findings on practices and/or student attitudes that affect girls' math attitudes and performance. Suggested strategies,



activities, and resources that teachers can use to address each topic are described. Suggestions are based on research findings, published resources, and practical ideas from math teachers. Most of the activities include math skill practice. Activities for teachers include journal keeping; self-evaluations of nonsexist behavior in the classroom; and self-assessments for active teaching attention patterns, sex segregation, classroom discipline patterns, and classroom verbal evaluation patterns. Ideas are included to help teachers promote mathematics as a worthwhile and important subject and involve parents, counselors, administrators, and other teachers. Each chapter ends with an annotated resource list of materials that contain related ideas and activities. (AM) ENC-000188

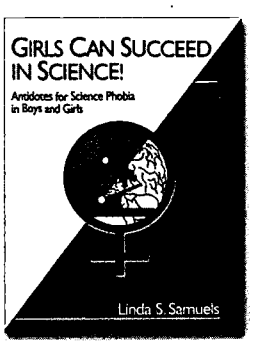
Girls Can Succeed in Science! Antidotes for Science Phobia in Boys and Girls

Grades 7-12
1999
Author: Linda S. Samuels

Ordering Information
Corwin Press, Inc.
2455 Teller Road
Thousand Oaks, CA 91320
Email: order@corwinpress.com
(805) 499-9774 / Fax: (800) 417-2466
www.corwinpress.com

$27.95 per book (paperback)

The teaching strategies and activities in this book are designed to counter misconceptions about science and gender that students have learned from various sources, including parents, teachers, and popular culture. The book is divided into three parts. Part one presents an overview of the factors that discourage many young women from studying science and discusses the roles of students, parents, and teachers in helping young women recognize their unique potentials as individuals. Part Two, Specific Tactics for Classroom Success, combines the educational literature on science for girls with the author's practical experiences in the classroom. This section includes a discussion of the tools needed to build a classroom that teaches boys and girls to love science; introduces a general approach to course design and creating a cooperative classroom atmosphere; and describes specific classroom procedures and activities that elevate self-esteem and promote student competence. Part Three contains activities for classes in life science, biology, and advanced biology. For each activity, the book summarizes the learning objectives and provides instructions. Reproducible student worksheets, sample examinations, and answer keys are also provided. (Author/LCT) ENC-015237



Challenge: Reaching and Teaching the Gifted Child

Series: Challenge: Reaching and Teaching the Gifted Child

Grades K-8
1999
Author: Good Apple

Ordering Information
Frank Schaffer Publications, Inc.
23740 Hawthorne Boulevard
PO Box 2853
Torrance, CA 90509
Fax: (800) 837-7260
Toll-free: (800) 264-9873
www.frankschaffer.com

$21.95 per magazine subscription (five issues per year)

The articles and ready-to-use activities in this periodical are designed to challenge gifted and talented children. Articles from the May/Summer 1999 issue include suggestions for enhancing reports and projects about the planets and boosting creativity. Another article provides background information about six types of plant movement: phototropism, hydrotropism, and geotropism as well as thigmotropism, thermotropism, and chemotropism. This issue also contains an integrated, activity-based unit on bubbles that includes whole-group introductory activities and cooperative small-group activities. Students share a story about bubbles and conduct experiments by dissolving different combinations of kitchen solids and liquids to find out which combinations produce reactions and which ones form solutions, emulsions, and mechanical mixtures. In other activities, students practice drawing blueprints for their dream house, develop qualitative analysis skills by estimating what objects will fit into a variety of paper grocery bags, and play a series of logic games. (Author/LCT) ENC-017161

ADD/ADHD Alternatives in the Classroom

Grades K-12
1999
Author: Thomas Armstrong

Ordering Information
Association for Supervision and Curriculum Development
1703 North Beauregard Street
Alexandria, VA 22311
Email: member@ascd.org
(703) 578-9600 / Fax: (703) 575-5400
Toll-free: (800) 933-2723
www.ascd.org

$11.95 per book (paperback)
$9.95 for ASCD members

Written for educators and parents, this book encourages readers to empower their students by looking for positive characteristics in learners who may carry the ADD/ADHD (attention deficit disorder/attention deficit hyperactivity disorder) label. The author challenges the traditional ADD/ADHD paradigm that suggests that these disorders are biological in origin by exploring other perspectives that shed light on the behavior of these children. The perspectives include historical, sociocultural, cognitive, educational, developmental, and psychoaffective domains that can be incorporated into a holistic framework that addresses the needs of the whole child. The book concludes with a variety of practical teaching strategies that address students' multiple intelligences, learning styles, and other brain-friendly approaches. For example, ADD/ADHD students may have stronger incidental learning tendencies that can be addressed by decorating the room with stimulating posters of the topics under study. Other classroom activities for kids who can't sit still might include showing patterns of molecular bonding in chemistry class through a "swing your atom" square dance. Mathematics teachers could help students master the multiplication tables by forming a conga line, moving around the classroom counting out loud and shaking their legs on every multiple of three. (Author/LCT) ENC-017222

Developing Mathematically Promising Students

Grades K-12
1999
Author: editor, Linda Jensen Sheffield

Ordering Information
National Council of Teachers of Mathematics, Inc.
1906 Association Drive
Reston VA 20191
Email: orders@nctm.org
(703) 620-9840 / Fax: (703) 476-2970
Toll-free: (800) 235-7566
www.nctm.org

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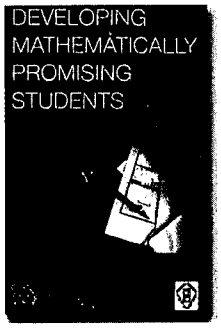


This book, written on the recommendation of the NCTM Task Force on Mathematically Promising Students, contains 34 papers that give an overview of current theories, models, and programs for the mathematically promising student. The Task Force described mathematical promise as a function of ability, motivation, belief, and experience or opportunity. The need to maximize both the numbers of such promising students and the levels of mathematical development and achievement is not confined to the United States; papers in this collection reflect the international need and interest in the education of gifted students. The question of how a culture of mathematics can be developed and fostered both within and outside of formal schooling is explored in further papers. Also considered is the need to create educational environments in which teachers of the mathematically promising are empowered and supported throughout their professional development; in which promising students from diverse backgrounds are identified and connected to educational and community resources; and in which parents are partners in the educational enterprise. In the final papers, writers share examples of successful programs and activities with replicable features and ideas that can be developed and tailored to the readers' situation. (Author/JRS) ENC-015657

Inclusion in Science Education for Students with Disabilities

www.as.wvu.edu/~scidis/

Grades K-12
2000
Author: Eberly College of Arts and Sciences, West Virginia University

Funded in part by the West Virginia Department of Education and the National Science Foundation, this web site presents inclusion and accommodation strategies for students with disabilities. Topics include teaching strategies, learning environments, and assistive or adaptive technologies. Eight general types of disabilities are presented across six science teaching methods, such as teacher presentation, laboratory use, and reading. For example, as a strategy to promote the success of students with attention deficit disorder when they engage in field experience, the site suggests that teachers provide clear and consistent transitions between activities and notify the students a few minutes before changing activities. (Author/JR) ENC-017171

The Inclusive Classroom: Mathematics and Science Instruction for Students with Learning Disabilities

Series: It's Just Good Teaching

Grades K-12
1999
Author: Denise Jarrett

Ordering Information
Northwest Regional Educational Laboratory
101 SW Main Street, Suite 500
Portland, OR 97204
Email: products@nwrel.org
(503) 275-9519 / Fax: (503) 275-0458
Toll-free: (800) 547-6339
www.nwrel.org

$7.65 per book (paperback)
1 copy free to residents of AK, ID, MT, OR, WA
(Internet version available free at www.nwrel.org/msec/book7.pdf)

The focus of this booklet, which is available in print and online, is on the educational needs of students with learning disabilities in inclusive classrooms. It is estimated that about half of all primary grade classes and about one-third of all secondary mathematics and science classes include students with learning disabilities. Each booklet in the series contains a summary of the research and current literature on a topic along with a discussion of effective strategies and an annotated listing of related resources. Material in this booklet demonstrates ways to help students of widely varying abilities learn concepts and skills in mathematics and science. The suggested strategies draw on the key principles of inclusion, special education, multiculturalism, and standards-based reform. Included are ideas to help with vocabulary acquisition in the science classroom and the use of calculators and computers in the mathematics classroom. The booklet also provides suggestions for building collaborative relationships with special education teachers and families of students with learning disabilities. (Author/JRS) ENC-016657

The Inclusive Classroom. Teaching Mathematics and Science to English-Language Learners

Series: It's Just Good Teaching

Grades K-12
1999
Author: Denise Jarrett

Ordering Information
Northwest Regional Educational Laboratory
101 SW Main Street, Suite 500
Portland, OR 97204
Email: products@nwrel.org
(503) 275-9519 / Fax: (503) 275-0458
Toll-free:(800) 547-6339
www.nwrel.org

$7.65 per book (paperback)
1 copy free to residents of AK, ID, MT, OR, WA
(Internet version available free at www.nwrel.org/msec/book7.pdf)

Part of the series described above, this booklet explores the specialized languages of mathematics and science and highlights strategies that link second-language acquisition techniques with content instruction. The author discusses techniques found to be particularly effective for helping language-minority students develop skills in using the specialized languages of mathematics and science. Suggested techniques include thematic instruction with units set in the context of students' everyday lives, cooperative learning that stresses authentic discourse for all students whatever their level of English proficiency, and inquiry and problem solving lessons that progress from concrete concepts to more abstract content. Several success stories in the teaching of language-minority students are featured. (Author/JRS) ENC-017095

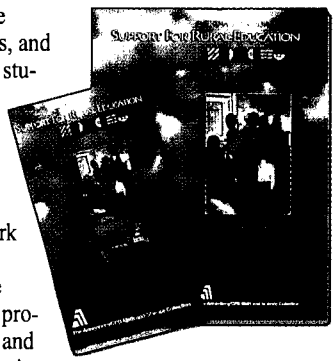
Support for Rural Education
Series: Mathematics and Science for All

Grades K-12
1996
Author: video directed by Ronald Tobias

Ordering Information
Annenberg/Corporation for Public Broadcasting
PO Box 2345
South Burlington VT 05407
(740) 369-5239 / Fax: (802) 846-1850
Toll-free: (800) 532-7637
www.learner.org

$49.95 per videotape and guidebook
$134.95 for series library (3 videos and guides)

This video and accompanying resource book are designed to show why math and science education for rural students needs to be reformed and how these students would benefit from the proposed changes. The series comprises three books and three videos that document the collaboration of seven mathematics and science education reform projects in Montana. These projects focus on specific groups of students—underserved Native Americans, students with special needs, and rural students—but all seek to help all students learn mathematics and science. Addressing issues of interest to parents, teachers, administrators, and other community members, the three programs mentioned on this video are National Teacher Enhancement Network (NTEP), Systemic Teacher Excellence Preparation (STEP), and Reach for the Sky (RFTS). A common goal of these programs is to integrate students' cultural and classroom experiences. This video contains suggestions for teaching across cultures and recommendations for change in this area. (Author/LDR) ENC-010141



Teaching Math to Visually Impaired Students
www.tsbvi.edu/math/index.htm

Grades K-12
2000
Author: Susan A. Osterhaus
Publisher: Texas School for the Blind and Visually Impaired

Developed by a secondary mathematics teacher at the Texas School for the Blind, this web site offers detailed information about issues related to teaching mathematics to visually impaired students. The developer uses a question-and-answer format to address a series of questions related to the challenges involved in teaching mathematics to the blind. Author Susan Osterhaus suggests methods for teaching mathematics topics including solving quadratic equations; finding linear measure, area, and perimeter; and doing geometric constructions. Other questions deal with the use of Braille and the Nemeth Code, which allows blind students to use Braille for all necessary mathematical symbols, even for the highest levels of mathematics. Practical considerations, such as the types of tactile graphics and where to obtain large-display scientific/graphing calculators, are also discussed. This site includes links to many sites supporting the teaching and learning of visually impaired students. (Author/JRS) ENC-017234

Being Deaf
Series: Think About

Grades 2-6
2000
Author: Maggie Woolley
Publisher: Smart Apple Media

Ordering Information
The Creative Company
PO Box 227
Mankato, MN 56002
Fax: (507) 388-2746
Toll-free: (800) 445-6209

$15.95 per book

Readers of this book are asked to imagine what life would be like if they were deaf. The book is part of a series designed to help young readers learn how physical and mental disabilities affect millions of people. Each book is written by an author affected by the title's disability and addresses the struggles, special needs, and successes of disabled people. In this book, readers learn about causes of deafness, technological aids that help deaf people in day-to-day life, and examples of deaf people who have become successful. Author Woolley discusses historical developments, such as sign language, hearing aids, and telephone adaptations. Sidebars contain situations for the readers to consider. For example, readers are asked to think about the fact that information announced over public address systems needs to also be visually displayed for the hearing impaired. Also in the series is *Being Blind* (ENC-016857). (Author/JR) ENC-016858

TECHNOLOGY AND EQUITY

Professional Development

Closing the Equity Gap in Technology Access and Use: A Practical Guide for K-12 Educators

Grades K-12
1997
Author: Barbara Warren-Sams

Ordering Information
Northwest Regional Educational Laboratory
101 SW Main Street, Suite 500
Portland, OR 97204
Email: products@nwrel.org
(503) 275-9519 / Fax: (503) 275-0458
Toll-free: (800) 547-6339
www.netc.org/equity

$10.00 per book
1 copy free to residents of AK, ID, MT, OR, WA
(Internet version available free at www.netc.org/equity)

Written for district planners, technology committee members, and classroom teachers, this report presents the inequities identified in technology access and use as well as possible solutions. It uses a set of questions to increase the readers' awareness of the inequities, describes a planning process to ensure equity in technology, and includes a literature-based list of strategies to solve technology equity issues. The questions are meant to serve as a springboard for reflection and as an assessment tool for the students' access to technology within the schools. Sample forms are included to help educators collect information about computer laboratory use and technology course enrollments. The strategies are designed to help schools deal with access, use, and curriculum inequities. Each strategy list is categorized further into areas of concern. A list of additional resources includes web sites and addresses for agencies that can provide information about funding, adaptive technology, and material assessment. (Author/JR) ENC-016864

What Is Computer Equity? A Trainer's Workshop Guide

Grades K-12
1991
Author: Jo Sanders and Mary McGinnis

Ordering Information
Scarecrow Press, Inc.
15200 NBN Away
PO Box 191
Blue Ridge Summit, PA 17214
(747) 794-3802 / Fax: (800) 338-4550
Toll-free: (800) 462-6420
www.scarecrowpress.com/crow.html

$25.00 per manual

The materials in this binder are for conducting a two-and-a-half-hour introductory workshop to help educators understand the issues surrounding computer equity and girls' computer avoidance. This workshop material is designed to be used by any person with teaching experience who is knowledgeable about computer education and technology use in schools and who is committed to gender equality. The workshop presentation is built around the answers to four questions: Where is the computer gender gap seen? What causes it and why does it matter? and What can be done about it? Organizational details for a workshop are included along with reproducible materials to use with the presentation. The presentation focuses on the consequences

of the computer gender gap on the labor market, how computer skills affect job pay, and the need for technologically literate citizens. In a sample activity designed to enable participants to leave the workshop with actual plans for trying out one strategy in their school, small groups work through a worksheet titled Next Steps. They apply the computer equity principles developed earlier and then share their action ideas with the other groups. The final resource section of the binder offers suggested responses to 13 commonly voiced objections to computer equity issues; handout and overhead templates; and suggested resources related to computer and gender equity and computer education. (Author/JRS) ENC-014082

Computer Equity in Math and Science: A Trainer's Workshop Guide

Grades K-12
1991
Author: Jo Sanders and Mary McGinnis

Ordering Information
Scarecrow Press, Inc.
15200 NBN Away
PO Box 191
Blue Ridge Summit, PA 17214
(747) 794-3802 / Fax: (800) 338-4550
Toll-free: (800) 462-6420
www.scarecrowpress.com/crow.html

$25.00 per manual

Designed as a follow-up to the previous workshop, this binder contains materials for conducting a two-and-three-quarter-hour workshop designed to give mathematics and science teachers and administrators strategies for overcoming girls' computer avoidance, thereby promoting girls' interest in mathematics, science, and computers. In a sample activity, participants in small groups assess, from an equity point of view, a piece of computer software commonly used in a math or science classroom. Groups complete a worksheet with questions about sexual stereotyping, levels of violence and competition depicted, and whether the material is relevant to the real world. A whole group discussion of the evaluations follows. Strategies for resolving equity issues that might be considered include avoiding inequitable software or talking about the equity problem with the class and having students write a letter of protest to the publisher about equity issues. The final resource section of the binder contains a bibliography of materials related to girls and women in math and science, sources of models for equity conferences and workshops, and related classroom activities and materials along with handouts and overhead templates for this workshop. (Author/JRS) ENC-014094

The Technology Connection
Series: Turning on All Students to Math, Science, and Technology

Grades K-12
1997
Author: senior producer, Maura Kelly; directed by Bob Morris

Ordering Information
Great Plains National
PO Box 80669
Lincoln, NE 68501
Email: gpn@unl.edu
(402) 472-2007 / Fax: (800) 306-2330
Toll-free: (800) 228-4630
gpn.unl.edu

$59.95 per video

Part two of the Turning on All Students series, this video examines how educational technology—from video to online telecommunications—enhances mathematics and science education for all students. Documentary segments profile teachers modeling specific techniques to make educational technology an interactive and compelling tool to improve student learning. In particular, one middle school mathematics teacher narrates her use of instructional video segments to demonstrate the real world application of quadratic equations to genetics and to demonstrate the variety of people who engage in scientific research to her culturally diverse eighth-grade class. In a roundtable discussion, NTTI National Director Sarah Feldman, Cornelia Brunner, associate director of the Center for Children and Technology, Carla Seal-Warner, educator and advocate for quality children's television, and NTTI master teacher Dorothy Suecoff discuss ways in which instructional television illuminates abstract concepts; how it illustrates diverse role models and a variety of careers in mathematics, science, and technology; and how it can be used to address a wide range of learning modalities. (Author/GMM) ENC-015105

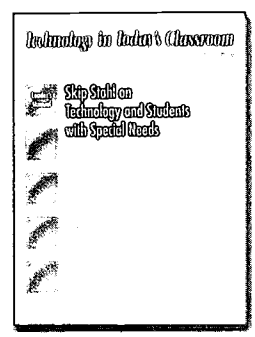
Technology and Students with Special Needs
Series: Technology in Today's Classroom

Grades K-12
1998
Author: Skip Stahl; executive producer, Marlene Canter

Ordering Information
Canter & Associates
PO Box 2113
Santa Monica, CA 90407
Fax: (310) 394-6017
Toll-free: (800) 262-4347

$199.00 per video with leader's manual (paperback)
$599.00 per five-program set

This video and leader's guide explain how computer technology can be used to help students with learning and physical disabilities overcome obstacles that otherwise prevent them from completing assignments or participating in activities. The series is designed to expose educators to the potential of new and existing technologies as well as provide them with instruction on how to infuse technology into their teaching practices. The first program in this module emphasizes the importance of varying curriculum to meet diverse student needs. The presenter stresses that technology increases the students' independence and self-esteem, promotes inclusion, and provides all students with alternative methods for learning. Assistive technology and adaptive curricula are identified as two categories of technology use. The second program involves teachers in identifying and implementing technologies that fit their individual students' needs. Students and teachers show how they have used the technologies to overcome barriers in elementary, middle, and high schools. The accompanying leader's guide outlines the workshop objectives, identifies the key points, and contains presentation plans. (Author/JR) ENC-017144



Instructional Materials

SCIENCE

Playtime Is Science: An Equity-Based Parent/Child Science Program

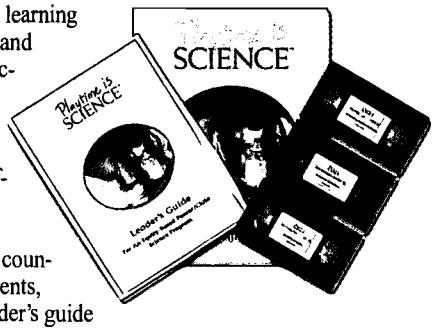
Grades PreK-3
1997
Author: project directors, Barbara Sprung and Merle Froschl

Ordering Information
Educational Equity Concepts, Inc.
114 East 32nd Street
New York, NY 10016
Email: edequity@con2.com
(212) 725-1803 / Fax: (212) 725-0947
www.edequity.org

$24.95 per set of 10 activity cards
$69.95 per facilitator's guide with activity cards and poster
$249.95 per complete kit

This kit, developed for grades preK through 3, is an equity-based parent/child science program that incorporates science and scientific thinking into children's daily routines through a series of hands-on physical science activities. The program is designed to create a partnership between school, home, and community that will improve science learning for all children. The kit includes a facilitator's notebook, a set of three videotapes, a leader's guide, and a poster. The facilitator's notebook provides a discussion of the program's science equity philosophy, formats for teacher and parent training workshops, and ten core activities. The workshop materials include program formats, training tips, outreach tools, and additional resources. The activities, printed on laminated cards, use inexpensive and recyclable items such as cooking oil, plastic bottles, empty boxes, and old socks. Each card provides a procedure, lists time and material

requirements, and summarizes learning objectives, skills development and equity goals, and career connections. It also provides ideas for home connections, integrating the activity into other subject areas, and grade-specific modifications. The videos, filmed in schools, homes, and community settings across the country, feature interviews with parents, teachers, and students. The leader's guide provides materials for training teachers to implement Playtime is Science, including equity and hands-on science activities, planning and self-assessment tools, organizing tips, and training agendas. (Author/LCT) ENC-011185



Exploring Environments

Series: AIMS Activities

Grades K-6
1999
Author: Sheryl Mercier, Evalyn Hoover

Ordering Information
AIMS Education Foundation
PO Box 8120
Fresno, CA 93747
(559) 255-4094 / Fax: (559) 255-6396
Toll-free: (888) 733-2467
www.aimsedu.org

$16.95 per activity book (paperback)

This book provides explorations in which students investigate different environments as though they were taking an expedition through each. It employs an open-ended, student-centered approach. The series integrates mathematics and science with other curricular areas including language arts, social studies, physical education, art, and music. The teaching activities are divided into three grade-level spans, K to 2, 3 to 4, and 5 to 6. Each grade span has a particular focus. Students in K to 2 study the characteristics of organisms, students in grades 3 to 4 associate organisms with their environments, and students in grades 5 to 6 independently investigate the ecological interactions of organisms. The activities offer teachers ways to assess the students' preexisting knowledge and then help them develop ideas, apply knowledge in projects that could be used for assessment, and integrate the concepts with other curricular areas. Eight of the twelve sections of the book contain information about specific ecosystems, such as rivers, prairies, or polar lands. Within these sections, teachers can find blackline drawings of the environmental scene with pictures of organisms; these sections also contain background information about the ecosystems. Reproducible handouts are found throughout the book. (Author/JR) ENC-015858

MicrobeWorld Activities

www.microbeworld.org/mlc/pages/activities.asp

Grades K-6
1999
Author: primary editor, Kathy Frame

Ordering Information
National Association of Biology Teachers
12030 Sunrise Valley Drive, Ste 110
Reston, VA 20191
(703) 264-9696 / Fax: (703) 264-7778
Toll-free:(800) 406-0775
www.nabt.org

Free activity book (paperback)

This book, available online and in print, contains 17 activities that introduce biological concepts and correlate with the four-part Public Broadcasting System (PBS) video series Intimate Strangers: Unseen Life On Earth. Each activity begins with an introductory statement to stimulate student interest. Each is divided into facilitator and reproducible participant pages. The facilitator pages outline the activity goals, classroom management information, and data analysis. The participant pages list the steps for setting up the activity, reflection questions, and self-assessments. The guide also offers ideas about modifications for students with special needs. Tables designate which activities address specific National Science Educational Standards and student performance standards. The activities have students visualize large numbers and calculate microbial population growth; investigate how microorganisms contribute to decomposition; and explore how natural selection results in changes in the population. (Author/JR) ENC-017037

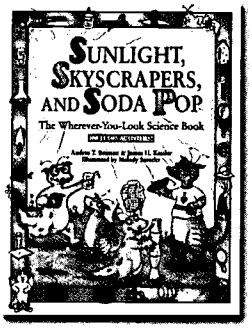
Sunlight, Skyscrapers, and Soda-Pop: The Wherever-You-Look Science Book

Grades K-6
1998
Author: Andrea T. Bennett, James H. Kessler

Ordering Information
American Chemical Society
Department 1195
1155 16th Street, NW
Washington, DC 20036
(800) 209-0423 / Fax: (202) 872-6067
Toll-free:(800) 227-5558
www.acs.org/edresources.html

$12.95 per activity book (paperback)

This book contains hands-on, science activities that are designed for students and an adult partner. It follows fictional creature siblings Sally and Sammy through their day as they realize that there are interesting scientific phenomena all around them. Each pair of activities begins with a picture of Sally and Sammy in an everyday situation as they describe in rhyme their observations. For example, while they are in the kitchen fixing breakfast, an egg breaks on the floor. One of the activities that accompanies this scenario allows the students to discover the strength of the dome shape of eggshell halves. The characters in the book challenge the readers to find in other scenarios examples of the tested scientific principles. The strength of the dome activity is demonstrated in a picture of the ballpark with one of the characters sitting on a batting helmet. Answers to the science search challenge and explanations of the hands-on activities are provided at the end of the book. (Author/JR) ENC-015498



Family Science

Grades K-8
1999
Author: editors, David Heil, Gayle Amorose, Anne Gurnee, Amy Harrison
Publisher: Portland State University

Ordering Information
Foundation for Family Science
6420 SW Macadam Ave, Suite 208
Portland, OR 97201
(503) 245-2102 / Fax: (503) 245-2628
www.familyscience.org

$23.95 per activity book (paperback)

This activity book presents hands-on activities for families or small class groups to enjoy together. Family Science, modeled after the Family Math series, is an informal science education program that gives parents and children an opportunity to work and learn together. Hands-on activities use inexpensive and readily available materials, and highlight the relevance of science to daily life. The goal of the program is to get parents more involved in their children's science education by offering opportunities for families to participate in group science activities. The book begins by illustrating how to create a learning environment at home that makes science approachable, safe, and fun. Subsequent chapters cover such topics as Science at Work, Using the Language of Science, Observing Your World, The Physical World, Design and Technology, and Organizing a Family Science Event. (Author/YK) ENC-016651

The Most Beautiful Roof in the World: Exploring the Rainforest Canopy

Series: Gulliver Green

Grades 3-8
1997
Author: Kathryn Lasky; photographs by Christopher G. Knight

Ordering Information
Harcourt Trade Publishers
6277 Sea Harbor Drive
Orlando, FL 32887
(619) 699-6707 / Fax: (800) 235-0256
Toll-free: 800) 543-1918
www.harcourtbooks.com

$18.00 per book (library binding)

This book uses color photographs to show how Meg Lowman, director of research and conservation at the Marie Selby Botanical Gardens and mother of two young boys, performs her job, satisfies her interest in nature, and shares her experiences with her children. The book helps the readers gain an appreciation of the personality of this female botanist, the scientific techniques she uses, and her outlook on life. The book describes her work collecting and classifying the organisms that exist in the rainforest canopies around the world. The book outlines the dangers related to working in the rainforest canopy, including the problems that gravity and poisonous animals can pose. Readers gain an understanding of Lowman's work and personal aspects of her life when they read about a trip that she and her sons took to Belize. In addition to descriptions of her research and data collection work, the book describes the boys' trip into the canopy and their pleasure at seeing exotic species for the first time. A glossary of scientific terms is included. (Author/JR) ENC-015488

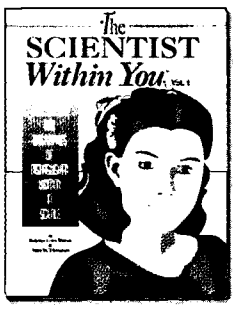
The Scientist Within You, Volume 1: Experiments and Biographies of Distinguished Women in Science

Series: Scientist Within You

Grades 3-8
1996
Author: Rebecca Lowe Warren and Mary H. Thompson

Ordering Information
ACI Publishing
151 Riverwood Street
Richland, WA 99352
Email: alphaci@aol.com
(509) 628-8578 / Fax: (509) 628-8051
Toll-free: (800) 935-7323

$21.95 per book



This book highlights women's achievements in science and mathematics from the first century A.D. to the present. Included are paleontologists, geologists, astronomers, mathematicians, chemists, physicians, an entomologist, and atomic physicists from European, African American, Native American, Mexican American and Asian cultures. Their noteworthy accomplishments are conveyed to students through hands-on experiments and activities. Included are 25 discovery units featuring a hands-on activity, a bibliography, a newsletter, and biographical information about the scientist profiled. The information and activities are suitable for grades 3-8. (Author/AD/SXA) ENC-003618

Science in Early Islamic Cultures

Series: Science of the Past

Grades 4-7
1998
Author: George Beshore

Ordering Information
Grolier Classroom Publishing Company
90 Sherman Turnpike
Danbury, CT 06816
(203) 797-3500 ext. 3967
Fax: (800) 374-4329
Toll-free: (800) 621-1115
www.publishing.grolier.com

$8.95 per book (paperback)

This book, part of the Science of the Past series, provides a historical perspective on the ancient Muslims' accumulation of knowledge about scientific phenomena and mathematical relationships. The series discusses the origins of science in the world's earliest civilizations and connects modern scientific accomplishments to the healers, mathematicians, and thinkers of the ancient world. This book outlines how the ancient Islamic civilization benefited from its scientific and technological knowledge. It shows how medical care, accurate calendars, and metal working affected people's lives. The book discusses how Muslims' study of mathematics resulted in the Arabic numbering system, refinement of algebra, and measurement of the earth. The author credits the Muslims with linking ancient scientific discoveries with modern knowledge and approaches to science. Activities are provided that illustrate refraction of light and construction and use of an astrolabe. Color illustrations and photographs are found throughout the book. A glossary and lists of additional resources are included. Additional titles in this series cover ancient China, ancient Rome, and ancient Egypt. (Author/JR) ENC-016295

Spill the Beans and Pass the Peanuts: Legumes

Series: Plants We Eat

Grades 4-7
1999
Author: Meredith Syles Hughes

Ordering Information
Lerner Publications Company
1251 Washington Ave. N
Minneapolis, MN 55401
(612) 332-3344 / Fax: (612) 204-9028
Toll-free: (800) 328-4949
www.lernerbooks.com

$26.60 per book (library binding)

This book contains information about leguminous plants, those plants that pack seeds into pods. The leguminous plants discussed include peanuts, lentils, peas, and beans with special emphasis on soybeans. Color photographs and illustrations accompany the information about the habitats, physiology, and common uses of these fruits. The plants' photosynthetic capabilities, life cycle, and economic importance are introduced. Nutrition facts and agricultural concerns are described. An ethnic recipe is included in each chapter. (Author/JR) ENC-015961

SPACES (Solving Problems of Access to Careers in Engineering and Science)

Series: Math and Career Activities for Elementary and Secondary Students

Grades 4-10
1982
Author: project director, Sherry Fraser

Ordering Information
Dale Seymour Publications
4350 Equity Drive
PO Box 2649
Columbus, DH 43216
Fax: (800) 393-3156
Toll-free: (800) 231-3106
www.pearsonlearning.com

$18.95 per book (spiral-bound)

This book contains a collection of 32 activities designed to strengthen problem-solving skills and increase students' awareness of the relationship of problem solving to scientific careers. Another important goal is to help students become aware of the importance of women's participation in science and to encourage older students to consider a scientific career as an option for themselves. The activities are divided into six categories designed to introduce students to a range of mathematics topics and provide experiences in developing logical reasoning. Design and Construction, for example, emphasizes planning ahead, visualizing different uses of spaces and materials, and making model representations. In these activities, students explore architecture, engineering, and drafting by designing and constructing models of a room, a veterinarian's office, and a park. The activities in the Tool category covers the use of standard tools, and Women in Careers presents the histories of women pioneers in science and technical fields. Other categories help students examine their attitudes about mathematics and present a group of activities to inform students about job requirements and definitions. (Author/LCT) ENC-017010

African and African American Women of Science: Biographies, Experiments, and Hands-on Activities

Series: Women of Science

Grades 5-12
1998
Author: Leonard Bernstein, Alan Winkler, Linda Zierdt-Warshaw

Ordering Information
Peoples Publishing Group
299 Market Street
Saddlebrook, NJ 07663
Fax: (201) 712-0045
Toll-free: (800) 822-1080
peoplespublishing.com/index.html

$19.99 per student book (paperback)
$7.95 per teacher's guide (paperback)

This book explores the scientific contributions of 15 African or African-American women and examines representative scientific concepts from their fields. The series offers positive multicultural, female role models with biographical sketches that outline the social and economic challenges that female scientists have had to overcome. Each book in the series presents timelines of the women's lives and hands-on activities that relate to their area of specialization. The women have careers in medicine, engineering, physics, chemistry, and environmental studies. The hands-on activities contain a list of materials, background information, and directions. Questions accompany the activities to allow the students to analyze their results, draw conclusions, and critically think about the information presented in the biographies. Students extend the lesson by choosing three of four or five research options. The book also includes thumbnail sketches of 22 other African American women of science, medicine, and technology. This series also includes *Latino Women of Science* (ENC-016201) (Author/JR) ENC-016202

Science Projects for ALL Students

Grades 5-12
1998
Author: Marty Berda, Mary Jean Blaisdell

Ordering Information
Facts on File
11 Penn Plaza
New York, NY 10001
(212) 967-8800x296
Toll-free: (800) 322-8755

$165.00 per book (loose-leaf)

This compilation of earth, life, and physical science experiments is designed to provide ways for students with developmental or physical challenges to join their classmates in hands-on activities. The activities, printed on card stock and contained in a binder, include the safety precautions and materials lists. Background information is provided and the scientific terms related to an activity are listed in the margin. Instructions explain how to perform each activity and questions are offered to help guide the students' observations. Data sheets and line drawings are provided with the instructions. The author's results from the activities, a list of references and additional activities, and guidelines for working with students with disabilities are included. The binder also offers suggestions for adaptations of each activity for students with visual and motor disabilities. A glossary contains definitions of the technical terms. (Author/JR) ENC-016578

Event-Based Science

mcps.k12.md.us/departments/eventscience

Grades 6-8
2000
Author: Montgomery County Public Schools

This web site provides information and supporting activities for the Event-Based Science (EBS) project (funded by NSF and published by Dale Seymour) as well as links to related Internet sites. Event-Based Science is a middle school curriculum that teaches science through newsworthy events. Authentic tasks are designed to create the need to know more about science topics. Interviews, photographs, web pages, and inquiry-based science activities are also used to create a desire to learn. The curriculum contains 15 modules that explore topics in earth science, physical science, and life science. For each module, this web site provides an overview of the content as well as links to related web resources. A series of remote sensing activities are under development through a grant with NASA and the Goddard Space Center. An activity from the Earthquake! module, for example, provides Landsat images from NASA that students use to analyze urban development with respect to seismic activity. A second activity enables students to investigate seismic activity along faults in the San Francisco Bay region of California. (Author/LCT) ENC-017061

What a Find! A Problem-Based Unit

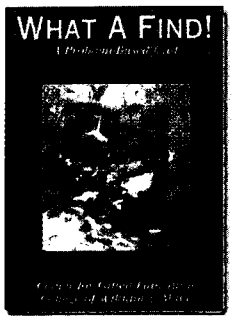
Series: Problem-based Science Units

Grades 6-8
1997
Author: Francis T. Cawley

Ordering Information
Kendall/Hunt Publishing Company
4050 Westmark Drive
PO Box 1840
Dubuque, IA 52004
Fax: (800) 772-9165
Toll-free: (800) 770-3544
kendallhunt.com

$32.95 per teacher's guide (paperback)

Developed for high-ability students, this curriculum unit provides an introduction to the field of archaeology. The series comprises a supplementary curriculum designed to integrate science process, content, and the concept of systems through the study of real-world problems. Each unit is organized around a central problem that is mapped out into specific lessons with assessment approaches that include problem logs, experimental design worksheets, and lab report forms. This unit contains 15 lessons that vary in length from one class session to two or three weeks. The unit begins with an ill-defined problem in which students are put into the role of



junior archaeologists at a research museum and discover that construction work has been halted on a new school because of the discovery of historic artifacts. To determine whether the dig is important enough to halt building the school, students learn to conduct a dig on a site that the teacher has seeded with artifacts. For each lesson, the guide provides a summary of the lesson length, its instructional purpose, and required materials and handouts. It also provides a list of discussion and hands-on activities for each class session, questions for the teacher to ask, and suggested assessments and extension activities. (Author/LCT) ENC-014780

Basic Genetics: A Human Approach

Grades 9-12
1999
Author: Joseph D. McInerney, Ronald G. Davidson, Edward Drexler

Ordering Information
Kendall/Hunt Publishing Company
4050 Westmark Drive
PO Box 1840
Dubuque, IA 52004
Fax: (800) 772-9165
Toll-free: (800) 770-3544
www.kendallhunt.com

$18.99 per student book (paperback)
$31.99 per teacher's guide (spiral-bound)

This two-volume set is the third edition of a human genetics curriculum developed by the Biological Sciences Curriculum Study (BSCS). This text uses individualized, open-ended experiences to introduce students to both the problems and the potentials of human and medical genetics. The third edition, updated to reflect progress from the Human Genome Project, emphasizes contemporary understandings of genetic diseases. The instruction emphasizes the social relevance of human genetics and the decision-making problems and opportunities that new findings engender. The student textbook uses a magazine format to give students new insights into themselves as a product of past heredity. A sampling of articles describes a family's struggle with cystic fibrosis, a boy with Down syndrome who wins the Special Olympics, and a student who creates a pedigree from data collected at his family reunion. Additional topics include prenatal diagnosis, genetic counseling, family planning, recombinant DNA technology, and treatment of heritable disorders. In sample activities, students analyze a pedigree for a complex condition and research and debate genetic screening. The teacher's guide provides background information, an overview of program goals, answer keys, masters of student worksheets, and bibliographic references. (Author/LCT) ENC-014848

Transportation
Series: Active Physics

Grades 9-12
1998
Author: Arthur Eisenkraft

Ordering Information
It's About Time, Inc.
84 Business Park Drive, Suite 307
Armonk, NY 10504
Email: itstimefor@aol.com
Fax: (914) 273-2227
Toll-free: (888) 698-8463
www.its-about-time.com

$15.95 per student book
$37.95 per teacher's guide

This curriculum module, developed for grades 9 through 12, presents forces and motion in the context of traffic safety and transportation. Active Physics, an activity-based curriculum series with limited math and reading skills prerequisites, is designed as an alternative physics course for high school students who would not normally enroll in physics. Each module in the course uses a thematic approach in which students learn about physics on a need-to-know basis as they explore issues in Sports, Medicine, Home, Transportation, and Communication. This module contains three chapters that explore distance, speed, and angular velocity; momentum, acceleration, and collisions; and force, mass, and gravity. Each chapter presents students with a problem or task that they will complete using the knowledge they gain in the chapter. The first chapter, for example, challenges students to demonstrate to their parents that they know how to drive an automobile safely and should therefore be allowed to drive the family car to a Friday night rock concert. Students work with their teacher to develop an assessment rubric for the projects. Students must support their positions with the experimental results and research or information presented in the chapter. In a sample laboratory activity, students measure the response of cars to the yellow traffic light and explore a spreadsheet model of an intersection. Each activity is accompanied by brief readings and sample problems designed for grade 9 math and reading levels. The activities conclude with reflective readings that relate the activity to a larger challenge, homework problems, and extensions. A teacher's guide is also available. (Author/LCT) ENC-012932

MATHEMATICS

Instructional Materials

Family Math for Young Children-Comparing
Series: Family Math

Grades K-4
1992
Author: Jan M. Goodman

Ordering Information
GEMS
University of California, Berkeley
Lawrence Hall of Science #5200
Berkeley CA 94720
(510) 642-7771 / Fax: (510) 643-0309
www.lhs.berkeley.edu/

$21.00 per book

This book, designed for parents with children in grades preK to 3, explores the theme of comparing as applied to numbers and measurements. The book tells parents how to set up a Family Math for Young Children class, how to be more involved at school, and how to help children at home. It uses games, activities, and explorations that integrate logical reasoning, measurement, geometry, and spatial thinking as well as probability, estimation, arithmetic, and other important mathematical skills. Describing Family Math as parents and kids enjoying and learning math together, this book incorporates beans, buttons, pennies, and toys in solving math problems. These objects may be used to explore shapes and geometry, estimate numbers and sizes, complete activities and play games, work and talk with others, and connect math and real life. This book contains material adapted from the EQUALS program, which focuses on students of color, girls, children from low-income families, and those from language minority groups. (Author/LDR) ENC-010948

BIG: CALC

Grades K-5
1997
Author: Don Johnston Incorporated

Ordering Information
Don Johnston Incorporated
26799 West Commerce Drive
Volo, IL 60073
Email: info@donjohnston.com
Fax: (847) 740-7326
Toll-free: (800) 999-4660

$29.00 per CD-ROM package.
Contact vendor for information about multiple user licenses.

This CD-ROM contains software for an onscreen calculator with special features such as instant auditory feedback. The software is designed to be useful to people with learning, visual, and physical disabilities. The onscreen calculator keys are extra large. Color and font size for number buttons, display numbers, and background can be changed to increase visibility. Data are entered by mouse, keyboard, or alternate access methods, according to the user's needs.

The software contains six different calculator layouts, including a standard keyboard, phone pad, and number line. BIG:CALC is designed so that the user can hear and see numbers and calculations as they are entered. Speech options are available for buttons, numbers, function buttons, results, and entire equations. A user guide is included with the CD. (Author/JRS) ENC-017102

Access to Math

Grades K-6
1997
Author: Don Johnston Incorporated

Ordering Information
Don Johnston Incorporated
26799 West Commerce Drive
Volo, IL 60073
Email: info@donjohnston.com
Fax: (847) 740-7326
Toll-free: (800) 999-4660

$79.00 per CD-ROM package.
Contact vendor for information about multiple user licenses.

This CD-ROM contains software for a talking math worksheet program with onscreen and printable lessons for students and a worksheet generator for teachers. The software is designed to help students, including those with disabilities, increase computational skills in the arithmetic operations. The generator allows the teacher to individualize worksheets with a choice of skill level, number range, and equation style. Onscreen worksheets show number carrying, suggest hints for the student, and can guide students in step-by-step problem solving or independent work. Features of the onscreen display designed to help students are the use of coloring to visually organize problems, number size adjustments and zoom in/zoom out capability, and multisensory learning with feedback, using talking numbers for problems and solutions. Answer sheets can be generated for all problems. A user guide is included with the CD. (Author/JRS) ENC-017210

Count Your Way through China

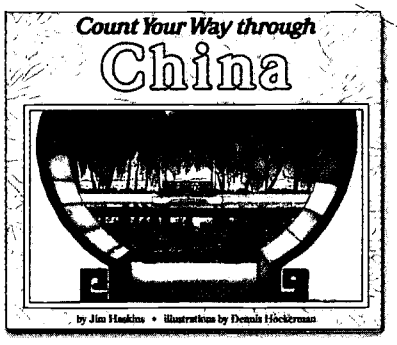
Series: Count Your Way...

Grades K-8
1982
Author: Joan Skolnick, Carol Langbort, Lucille Day

Ordering Information
Dale Seymour Publications
4350 Equity Drive
PO Box 2649
Columbus, OH 43216
Fax: (800) 393-3156
Toll-free:(800) 231-3106
www.pearsonlearning.com

$14.50 per book

This illustrated book introduces students to the culture and the written and spoken language of China. The Count Your Way series includes 16 books highlighting life in countries around the world. In this book students learn how to pronounce and write the numerals from one to ten in Mandarin, the official language of the People's Republic of China and the Republic of China (Taiwan). For each numeral there is a full-color watercolor illustration showing an aspect of Chinese life, along with the Chinese character for the numeral and a detailed explanation of political and social situations from China. A map of China, described as one country with two governments, illustrates the numeral one; in Chinese, *yee*. The number nine, *jo* in Chinese, is illustrated with a painting of Chinese farmers planting rice and an explanation of the Festival of the Nine Stars of the Plow, based on the legend of the falling star. The book closes with the definition of dynasty as a family or group that maintains power for several generations and a description of the ten major dynasties in Chinese history. (Author/JRS) ENC-014509



IntelliKeys

Grades K-8
1992-200
Author: IntelliTools, Inc.

Ordering Information
IntelliTools
1720 Corporate Circle
Petaluma, CA 94954
Email: info@intellitools.com
Fax: (707) 773-2001
Toll-free: (800) 899-6687
www.intellitools.com

$760.00 per IntelliTools Access Pac with IntelliTalk II, InlelliKeys
Access Pac also includes a CD-ROM with the following programs: IntelliPics, Overlay Maker, IntelliTalk II and ClickIt.
Contact vendor for ordering information and specifications.

This kit contains a computer accessory system designed to make computer-based curriculum materials available to people with physical, cognitive, and visual disabilities. Components include an adaptive touch-pad style keyboard and software for a talking word processor along with ready-made keyboard overlays and software for teacher-created keyboard overlays. This adaptive keyboard can also work with a switch interface to activate areas on the computer screen. Overlays work with a hot spot technology that replicates keystrokes on a standard keyboard. Premade overlays are bar coded to create computer access with a variety of keyboard configurations featuring large letters and numbers in high contrast colors. Included is an alphabetical overlay as well as a QWERTY overlay with the standard keyboard configuration of letters and numbers. A number overlay can be used to create access to commercial math programs that use only the number keys along with RETURN, SPACE BAR, ARROWS, ESCAPE, and BACKSPACE. With this computer accessory system, teachers can develop individualized activities for special needs learners. The accompanying software provides auditory support for the learner to see and hear the computer speak with each keystroke and then read back text, a letter, a word, or an entire sentence at a time. Intellikeys offers ready to use software programs for a variety of content areas along with a web site with user information and lesson suggestions. (Author/JRS) ENC-017440

Additional accessories for this system include MathPad (ENC-17426) and Exploring Patterns (ENC-17427). The MathPad software enables students with disabilities to solve problems just as they would using paper and pencil. The software guides the student through a problem while special keys on the MathPad overlay allow the student to decide when to regroup or when to show a remainder. Exploring Patterns allows the student who has difficulty using manipulatives to explore patterns with simulated manipulatives. With this software, the student can access online manipulatives to copy, complete, and create patterns of increasing complexity. Special features of the software include continuous auditory feedback and automatic creation of a portfolio of each student's work.

Contact dealer listed above for additional prices or search ENC Online for the full catalog records.

Number Games and Story Problems: Addition and Subtraction

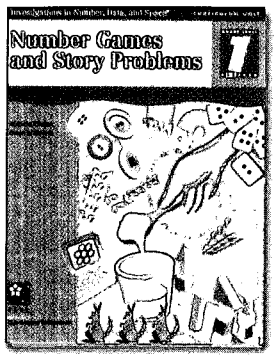
Series: Investigations in Number, Data, and Space

Grade 1
1998
Author: Marlene Kliman, Susan Jo Russell
Publisher: Dale Seymour Publications

Ordering Information
Scott Foresman Addison Wesley
PO Box 2649
4350 Equity Drive
Columbus OH 43216
Fax: (800) 841-8939
www.scottforesman.com

$25.25 per book

This teacher's resource book, part of the Investigations in Number, Data, and Space series for grade 1, focuses on the number system and number relationships. The series provides a complete K to 5 mathematics curriculum that aims to offer students meaningful mathematical problems that emphasize depth in mathematical thinking rather than superficial exposure to a series of fragmented topics. In contrast with the usual student textbook-based program, the Investigations curriculum is present-



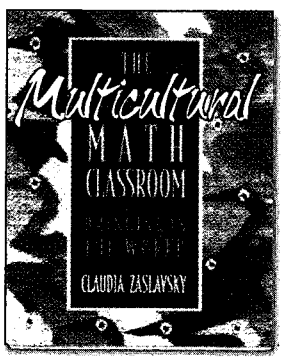
ed through a series of teacher books, one for each unit of study. Reproducible resources for students are provided, but the curriculum does not include student books. Students work actively with objects and experiences in their own environment and a variety of manipulative materials and technology rather than workbooks and worksheets. This book contains three Investigations. Each Investigation includes 10-13 sessions (with a session being defined as a one-hour math class). Activities include pair- and small group work, individual tasks, and whole class discussions. A sample Investigation, Number Combinations, emphasizes different combinations of a number, counting in rows or groups, and using equations. In Session 1, students are briefly shown images of arrangements of ten dots, then asked to copy the image from memory and share their strategies. In Sessions 2 and 3, students play two games. In one they combine dot cards to make given numbers, and in the other they toss counters over a piece of paper and record how many land on and off the paper. In later sessions students play other games, solve combination problems, and do puzzles with crayons. Recommendations for homework assignments and for follow-up activities appear at the end of each activity. Embedded assessment activities are recommended throughout each investigation. Portfolio and observational assessments are also recommended on an ongoing basis. (Author/CMS/KFR) ENC-010478

The Multicultural Math Classroom: Bringing in the World

Grades 1-8
1996
Author: Claudia Zaslavsky

Ordering Information
Heinemann Educational Books, Inc.
88 Post Road West
PO Box 5007
Westport CT 06881
Email: custserv@heinemann.com
(603) 431-7894 / Fax: (800) 203-1502
Toll-free: (800) 793-2154
www.heinemann.com

$25.00 per book



This teacher resource book includes eight chapters of lessons that introduce a multicultural perspective to the elementary and middle grades mathematics curriculum. The book begins with a rationale for multicultural mathematics education, then describes the works of mathematics educators who are bringing multicultural perspectives into their classrooms. The multicultural lessons that comprise the main body of this text provide background information with references, suggestions for cooperative learning activities that encourage creativity and critical thinking, and advice on opportunities for open-ended, long-range projects. One lesson, How People Use Numbers, teaches children about how numbers are used in trading within a variety of cultures, including West Africa, China, and Egypt. After learning about various systems of exchange, such as the use of wampum by the Iroquois and the use of cocoa beans by the Aztecs, students might pretend that they live in a culture that uses cowrie shells or beads for currency. This cooperative learning activity can be extended to include long-range projects such as setting up a model market place and investigating foreign exchange columns in daily news publications. (Author/CMS) ENC-008965

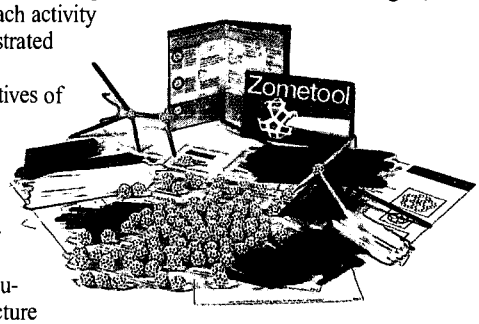
Zometool Explorer Kit

Grades 1-12
1998
Author: Zometool, Inc.

Ordering Information
Zometool
1526 South Pearl Street
Denver, CO 80210
Email: sales@zometool.com
(303) 733-2880 / Fax: (303) 733-3116
Toll-free: (888) 966-3386

$19.95 per lesson plans manual
$64.95 per student kit

This kit includes the Zome system of manipulatives and lesson plans for grades 1 to 12. The Zome system includes struts and Zome balls that can be used to build geometric, architectural, biological, and chemical structures and models. There are three types of struts that connect to the Zome balls in precise and predetermined ways so that students can build objects such as BuckyBalls and be certain that the angles are precise. The lesson plans provide ways for implementing activities that help students explore mathematical and scientific concepts such as the Platonic solids, angles, and similar triangles. Each activity gives complete and illustrated instructions as well as a description of the objectives of the lesson and the standards addressed. For example, one activity has students explore the idea of minimal surfaces using the Zome system and a bubble solution. By building a structure (such as a pyramid), and then dipping the structure in the bubble solution, the bubble solution will form a minimal surface inside that structure. A supporting web site offers additional ideas for activities as well as a teacher's forum for discussing ideas using the Zome system. (Author/RMK) ENC-013520



PlaneMath

www.planemath.com

Grades 4-7
Author: developed by InfoUse in cooperation with National Aeronautics and Space Administration (NASA)

This web site contains tutorial mathematics lessons, group activities, links to other sites, and information for teachers and parents of physically disabled students in grades 4 to 7. The mission of the project is to motivate students with physical disabilities to pursue aeronautics-related careers through accessible math education materials on the Internet. The goals are to increase curricula accessibility, to improve math proficiency, to inspire pursuit of aeronautics-related careers, and to provide access to innovative uses of technology. Problem scenarios are offered, along with the data necessary to solve the problem. The solution is presented upon request, and problem extensions are also available. Accommodations can be made for students with visual disabilities. Several topics of the National Council of Teachers of Mathematics (NCTM) *Curriculum and Evaluation Standards* (1989) for fourth-grade mathematics content are incorporated into the lessons. References for the problems and for various state standards are also listed. (Author/LDR) ENC-002245

Native American Geometry

www.earthmeasure.com

Grades 4-9
1994
Author: Chris Hardaker
Publisher: Geometric Explorations

On this web site, intricate and colorful designs from various Native American nations are used to describe this physical, proportional geometry that originates from the simple circle. The fundamentals of compass and straightedge constructions are included, along with instructions and templates

for the creation of geometric designs. These two-dimensional geometry constructions, designed to enhance students' spatial reasoning, use a simple dot connection approach and are grounded in the natural laws of proportion. Sources of this nonrandom geometry in a wide range of other cultures are also discussed as well as ideas linking art and mathematics. (Author/JRS) ENC-013761

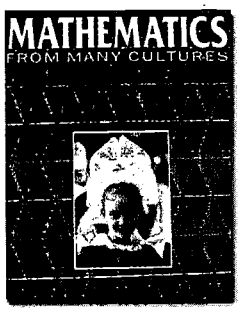
Mathematics from Many Cultures-Level F

Series: Mathematics from Many Cultures

Grade 5
1995
Author: Calvin Irons, James Burnett, Stanley Wong Hoo Foon, Dianne Vanderee

Ordering Information
Mimosa Education Inc.
50 South Steele, Suite 755
Denver, CO 80209
Email: info@mimosausa.com
(925) 875-0490 / Fax: (800) 646-6721
Toll-free: (800) 775-9597

$79.00 per kit



This kit, part of a series for grades K-5, integrates multicultural studies and mathematics by encouraging children to describe and compare the attributes of a variety of objects and counting systems from around the world. Each kit in this series uses brightly colored posters and Big Books to reinforce mathematics concepts and to help children see how these areas connect with a diversity of cultural backgrounds and experiences. This kit provides lessons and activities for six investigations in which students explore works of art from India, Persia, China, and Holland for symmetry, tessellations and transformations, examine number triangles, and investigate the development and use of measuring systems from cubit to meter. They also examine the never-ending networks drawn by the Bushoong and Tamil people, investigate number systems with bases other than ten, and explore the game Alquerque from Spain. The Big Book introduces each investigation for the students, while the teacher's guide provides three related activities and discussion questions for each investigation. The guide also provides introductory and historical notes, lists mathematics and cultural links, and includes blackline masters of student handouts. A Spanish language version is also available. (Author/LCT/JRS) ENC-011258

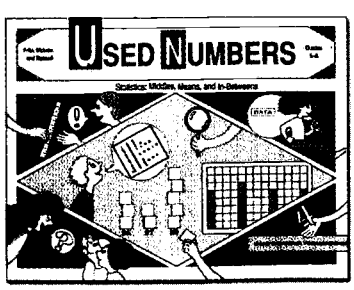
Statistics: Middles, Means, and In-Betweens

Series: Used Numbers: Real Data in the Classroom

Grades 5-6
1992
Author: Susan N. Friel, Janice R. Mokros, Susan Jo Russell
Publisher: Dale Seymour Publications

Ordering Information
Activity Resources Company, Inc.
PO Box 4875
Hayward CA 94541
Email: info@activityresources.com
(510) 782-1300 / Fax: (510) 782-8172

$12.95 per book



This book is part of a six-unit series that engages students in the collection, recording, discussion, analysis, and interpretation of real world data. In this unit of study, students collect, represent, and analyze real data; compare data about different groups, use the median and mean as part of their descriptions of data sets; investigate the mathematical relationship between the mean and the data; and interpret the mean and median as characteristics of a data set that give some, but not all, information about the data. The unit includes an independent project in data analysis. The unit is organized into investigations. The investigations develop the following additional concepts and skills: looking for patterns in data sets, building theories based on data sets, estimating, computing, graphing, and problem solving. Each investigation includes a summary of the student activity, a list of needed materials, a list of important mathematical ideas, step-by-step suggestions that outline the students' explorations and the teacher's role, dialogue boxes that illustrate the special role of discussion in these investigations and typical student-teacher interactions, and teacher notes. The unit also includes a general discussion of data analysis and pedagogical techniques . Completion of the unit requires approximately 17 class sessions of about 45 minutes each. (AM) ENC-000671

Family Math, the Middle School Years. Algebraic Reasoning and Number Sense

Series: Family Math

Grades 5-8
1998
Author: Virginia Thompson, Karen Mayfield-Ingram

Ordering Information
EQUALS Publications
University of California, Berkeley
Lawrence Hall of Science #5200
Berkeley, CA 94720
Email: equals@uclink.berkeley.edu
(510) 642-1910 / Fax: (510) 643-5757
Toll-free: (800) 897-5036
equals.lhs.berkeley.edu

$19.95 per book (paperback)

This resource book, written for parents of students in grades 5 to 8 and useful for their teachers, is filled with fun, instructive, and nonthreatening math activities for families or small class groups to enjoy together. This is the third in a series of Family Math books that offer activities based on the National Council of Teachers of Mathematics standards. Most activities involve several integrated math concepts rather than isolated skills and aim to promote better student understanding and mathematics achievement. Algebraic thinking and the development of number sense are the focus of this book designed to help prepare students for advanced high school mathematics. One sample algebraic reasoning activity offers eight scenarios about a drawer containing black, blue, red, and white socks. For each scenario there is a set of clues and the family is challenged to find out how many socks of each color are in the drawer. The mathematics involved includes algebraic language, logical thinking, and proportional reasoning. In each activity, a section called Algebra Notes explains the mathematics behind the questions. This book introduces a new type of activity to the series: an investigative approach in which family members analyze, record, and draw conclusions about mathematical situations. Another new feature in this book is the parent advocacy chapter that provides a framework for families to make informed decisions about their children's math future. Also included are a bibliography and a list of resources for families; masters for charts, graphs and spinners; and suggestions for organizing a Family Math Middle School Class Series. (Author/JRS) ENC-014148

Off the Wall Math: Focusing on the Concepts, Not on the Numbers

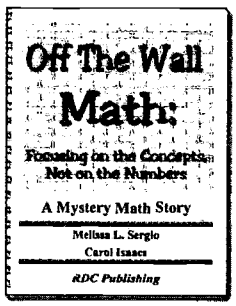
Grades 6-9
1995
Author: Carol Isaacs, Melissa L. Sergio

Ordering Information
Research Development Corporation
Suite A4
2875 Towerview Road
Herndon, VA 22071
(703) 904-1808 / Fax: (703) 904-1812
Toll-free: (800) 583-2248
www.eolinc.com

$19.99 per book

This workbook, designed to complement middle school mathematics curricula, requires students to interpret problems in terms of real world situations before they choose formulas that simply crunch numbers. The workbook requires the student to act as an undercover detective solving a mystery. In this mystery, vandals spread mysterious graffiti all over town. Commissioned as detectives, students attempt to infiltrate the group responsible for the vandalism. To solve this mystery, students must conceptualize real world problems that contain few numerical values. They first determine what information is needed to solve the problem, then use pictures or graphs to decide how the various pieces of information relate to one another. At

decide how the various pieces of information relate to one another. At this point, the authors contend, students are finally ready to process numbers, since the numbers have come to be seen as relevant to solving the problem. Mathematical concepts covered in this workbook range from fractions to percents. Tools used to facilitate the problem-solving process include frequency tables, charts, and graphs. Writing is encouraged throughout this process, as students are asked to respond to open-ended questions, to keep journals, and to set up a home page on the World Wide Web. This workbook provides opportunities for teachers to teach in interdisciplinary capacities, to have students work individually or in cooperative learning groups, and to use technology in the classroom. (Author/LDR) ENC-009087



Scatter Matters

Series: EQUALS Investigations

Grades 6-9
1994
Author: Lawrence Hall of Science, University of California at Berkeley

Ordering Information
EQUALS Publications
University of California, Berkeley
Lawrence Hall of Science #5200
Berkeley CA 94720
Email: equals@uclink.berkeley.edu
(510) 642-1910 / Fax: (510) 643-5757
Toll-free: (800) 897-5036
www.etdc.wednet.edu/equity/organizations/18.html

$21.95 per book
$100.00 for 1 set of 5 books

This four- to eight-week unit, part of the Work on Investigations Units series for the middle school, addresses the topics of scatter plots and cause and effect. The Investigation Units series was conceived and designed by the Investigations Mathematics Curriculum Project as a part of the EQUALS program at the Lawrence Hall of Science, University of California, Berkeley. EQUALS is a teacher education program designed to help elementary and secondary teachers acquire methods and materials to attract minority and female students to mathematics. This series of materials supports a problem-solving approach to mathematics and incorporates a broad mathematics curriculum presented to students in a variety of contexts. Each unit has a range of entry levels that allow students of varying experience to be challenged on an individual level and to fully participate. The units integrate language, writing, and hands-on work in cooperative settings and are designed to be used in bilingual or multilingual settings. Student pages are in English and Spanish. Students generate data about themselves to anchor statistical techniques in a context meaningful to them. Using their data they are encouraged to examine the relationships between sets of numbers, to use scatter diagrams to decide if two things are related, and to learn to distinguish between correlation and cause and effect. (Author/GMM) ENC-008615

Exploring Solid Geometry, Part 2: Volumes and Surface Areas of Solid Figures

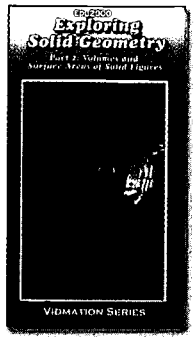
Series: Vidmation Series

Grades 8-12
1999
Author: directed by Mike Kelley

Ordering Information
Edu2000 America, Inc.
PO Box 2636
Carson City, NV 89702
(775) 887-1744 / Fax: (775) 887-1479
Toll-free: (800) 930-3212
www.education2000.com

$79.95 per set of videos (Parts 1-3)
$29.95 per video

This video explores the basic properties of solid geometry, focusing on the calculation of surface areas and volume. The seven-part videotape series uses computer animation, live action video, and graphics to explain geometric shapes and principles. These videos are useful for viewing by individual students as well as a whole class, and are also intended for viewing by the teacher as a learning aid. This video begins by showing a jet in flight and describing how surface area of an aircraft's wings affects the lift of the aircraft. Animations relate surface area to the sail on a sailboat. The detailed graphic presentation of the calculations for the lateral area of a cone is an example of the serious content presented in visual format. Animations also demonstrate informal proofs related to the formulas for the volume of solid geometric shapes. Other animations illustrate the concept of frustum and the meaning of Cavalieri's principle concerning the volume of solids. (Author/JRS) ENC-016435



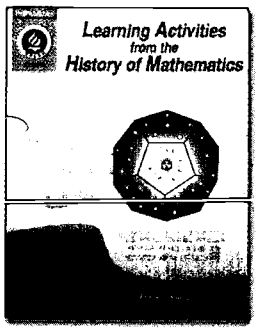
Learning Activities from the History of Mathematics

Grades 9-12
1994
Author: Frank J. Swetz

Ordering Information
J. Weston Walch Publisher
321 Valley Street
PO Box 658
Portland ME 04104
(207) 772-2846 / Fax: (207) 772-3105
Toll-free: (800) 341-6094

$25.95 per book (paperback)

This book serves as a resource for teaching mathematics history. It is not comprehensive, but a guide of ideas that teachers can use or modify for their particular needs. The beginning of the book provides a series of short biographies of famous mathematicians, each followed by a page of questions and investigations. A brief section on the history of mathematical words and famous quotes follows. The book then moves to historical problems and classroom activities. In one activity, students examine and work with medieval multiplication methods. In another, students investigate Pascal's triangle. Each of the 21 activities is accompanied by a brief teacher's guide that explains objectives and materials needed and offers appropriate notes and suggestions. A detailed bibliography is provided at the end of the book. (Author/KFR) ENC-006337



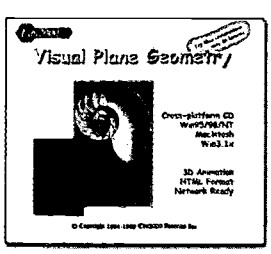
Visual Plane Geometry

Series: Visual 2000

Grades 9-12
1999
Author: Edu2000 Design Team

Ordering Information
Edu2000 America Inc
PO Box 2636
Carson City, NV 89702
(775) 887-1744 / Fax: (775) 887-1479
Toll-free: (800) 930-3212
www.education2000.com

$39.00 per CD-ROM (Windows/Mac)
Discounts for lab pack orders.



This CD-ROM explores the full curriculum content of plane geometry with a blend of text, computer graphics, and three-dimensional animation. The five CD-ROM series is designed to provide a resource base of grade 9 to 12 mathematics for teachers, students, and parents. On this CD-ROM, each plane geometry topic features three sections: a mathematical explanation, an animation illustrating the concept, and an exercise, with solution, for applying the concept. Examples of topics include basic geometric concepts, the Ruler Postulate, angle addition, and details for the use of protractors and the construction of triangles. As a sample of the content, in a brief introduction to reasoning and proof, the user learns the characteristics of intuitive, inductive, and deductive reasoning. The animation shows two optical illusions that illus-

trate problematic areas when applying inductive reasoning. One illusion deals with the length of sides of a triangle and the other shows how intersecting lines can visually distort a pair of parallel lines. The related exercise illustrates the application of deductive reasoning; the user considers the conclusions that can be drawn from a general and a specific statement related to a barking dog. (Author/JRS) ENC-016722

Group Solutions: Cooperative Logic Activities for Grades K to 4, Teacher's Guide

Series: GEMS

Grades K-4
1992
Author: Jan M. Goodman

Ordering Information
GEMS
University of California, Berkeley
Lawrence Hall of Science #5200
Berkeley, CA 94720
(510) 642-7771 / Fax: (510) 643-0309
www.lhs.berkeley.edu

$21.00 per book

This series of teacher's guides contains guided discovery activities that include step-by-step instructions and background information to allow presentation by teachers without special background in math or science. Activities and games in this book integrate science and math and are intended to develop such skills as observation, map reading, classification, sequencing, and communication. This book contains over 50 activities and provides groups of students opportunities to work and solve problems together using a modified version of cooperative logic, a highly structured form of cooperative learning. Through cooperative logic activities, each student receives a clue to a problem and needs to share the information with all other group members to find the solution. The entire group is responsible for finding the solution and it can only be found by connecting all the clues. A handbook series offers ways that the GEMS teacher's guides can be used from various perspectives and includes the teacher's handbook, leader's handbook, parent's guide, To Build A House (a thematic approach to science teaching), Once Upon A Gems Guide (literary annotations), and an Outcomes (assessment) handbook. Spanish translations of the blackline masters are available for the series. (Author/DEB) ENC-002789

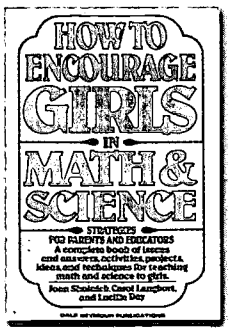
How to Encourage Girls in Math & Science: Strategies for Parents and Educators

Grades K-8
1982
Author: Joan Skolnick, Carol Langbort, Lucille Day

Ordering Information
Dale Seymour Publications
4350 Equity Drive
PO Box 2649
Columbus, OH 43216
Fax: (800) 393-3156
Toll-free:(800) 231-3106
www.pearsonlearning.com

$14.50 per book

Designed for grades K-8, this parent and educator guidebook examines effects of sex role socialization on girls' skills, knowledge, and confidence in mathematics and science and traces the pattern of girls' involvement with math and science from early childhood through adolescence. On the basis of this analysis, the book presents a variety of educational strategies and 69 math and science activities designed to develop girls' skills and confidence to pursue interests and careers in math and science. Drawing from the social sciences, women's studies, and math and science education, the book discusses such topics as the development of girls' spatial skills; how to help girls become scientific investigators; why more girls view failure as a result of innate inability; how to reduce learning anxiety; and how to improve logical reasoning ability. The educational strategies that are developed and demonstrated may be applied to any math or science activity. Strategies show how to promote independence and risk taking in problem solving; how to utilize manipulative materials and approaches to develop abstract reasoning skills; how to group children during activities to maximize learning and minimize negative peer pressure; and how to use math and science activities to model new sex roles and career possibilities. Each strategy and activity has been tested in classrooms or after-school programs. (AM) ENC-001298



CIESE Online Classroom Projects

216.0.165.241/currichome.html

Grades 3-12
2000
Author and Publisher: Stevens Institute of Technology

Sponsored by the Center for Improved Engineering and Science Education (CIESE), this web site contains projects that teachers can use to enhance their curriculum with the Internet. The site focuses on projects that use real-time data and on collaborative projects that apply the Internet's potential to reach peers and experts around the world. Each project has a brief description and links to the *National Science Education Standards* and National Council of Teachers of Mathematics (NCTM) standards it supports. As an example of the projects found here, The Stowaway Adventure uses live remote sensing data from cargo ships at sea to take students on a virtual adventure where they learn about navigation and use mathematics to calculate their ship's average speed in knots. In a follow-up adventure, students use satellite and radar images to identify upcoming storms on the ship's course. In addition to projects, there is an Ask An Expert Page, providing links to experts in a number of different fields. (Author/JRS) ENC-012233

Girls and Young Women Inventing: Twenty True Stories About Inventors Plus How You Can Be One Yourself

Grades 6-12
1995
Author: Frances A. Karnes, Suzanne M. Bean

Ordering Information
Free Spirit Publishing, Inc.
400 First Avenue North, Suite 616
Minneapolis, MN 55401
Email: help4kids@freespirit.com
(612) 338-2068 / Fax: (612) 337-5050
Toll-free: (800) 735-7323
www.freespirit.com

$12.95 per book (paperback)

The stories in this book are told by girls who designed products that could be used for a variety of purposes, including convenience, safety, and fun. Each girl's story begins with background information about her family and school. The girls describe how they thought of their inventions and the processes they used to develop them. They talk about the awards they have won and their patent application experiences. Many girls discuss their feelings about being female inventors. They credit parents, teachers, and other adults who helped them. After pointing out that women have been historically excluded from lists of inventors, the author presents a list of female inventors and their inventions from 3,000 B.C. to 1994 A.D. (Author/JR) ENC-016309

Ada Lovelace

Series: Connecting the Past with the Future: Women in Mathematics and Science

Grades 7-9
1993
Author: producer and director, Roger E. Kent

Ordering Information
Western Illinois University Department of Mathematics
Horrabin Hall 46
Macomb, IL 61455
Email: CPC@wiu.edu
(309) 298-1817 / Fax: (309) 298-2869
Toll-free: (800) 322-3905

$35.00 per set (videotape/booklets)
Series is also available on a CD-ROM entitled Connecting the Past With the Future: Women in Science and Mathematics

This program, developed for junior high school students, focuses on the historical contributions that women have made in the fields of mathematics and science and introduces present-day role models of women in mathematics or science careers. This video centers on women in mathematics and computer science and features Ada Lovelace, English mathematician, considered the world's first computer programmer. The modern-day role models for this program are Karen Powel, a senior manager of software development at McDonnell Douglas, and Janice Lukich, senior development engineer at Caterpillar, Inc. Three booklets accompany the videotape. One booklet contains biographical information about the women. Activities with suggested learning experiences in mathematics for students and pedagogical ideas for teachers are provided in another booklet. The history of computing and its relationship to Lovelace is discussed in another booklet. (Author/VN) ENC-001765

Networking Projects

www.glenbrook.k12.il.us/gbsmat/glazer/network.html

Grades 7-12
1998
Author: Evan Glazer
Publisher: Northfield Township High School District 225

Maintained by high school mathematics teacher Evan Glazer, this web site contains student projects ready for classroom use. Each project begins with a problem-solving scenario and provides a detailed list of requirements for carrying out the project and making the final report. Links to relevant real data are given, as well as links to supplementary lessons on how to program calculators to do the required statistical operations. Problem contexts range from investigating stock market options to converting money to different currencies for use on a vacation. Glazer's stated goal is to implement current trends in educational research in order to advance the mathematical knowledge of every student. A sample page at this site, Chopping Broccoli, examines how fractals relate to the idea of similarity. An illustration shows the iterations that a square can go through as it is transformed into a more complicated figure. After viewing further examples in geometry and in nature, students are asked to define iteration and, finally, to explain how chopping broccoli relates to similarity and fractals. A class handout is provided as are links to related sites. (Author/JRS/TAH) ENC-011990

For Further Reading

Asian-American Children: What Teachers Should Know

Series: ERIC Digest
equity.enc.org/equity/eqtyres/erg/111356/1356.htm

Grades PreK-12
1994
Author: Jianhua Feng
Publisher: ERIC Clearinghouse on Elementary and Early Childhood Education

This article provides information to help teachers gain a better understanding of Asian-American children and to identify culturally appropriate educational practices to use with those children. ENC-009581

We Want to Be Known: Learning from Adolescent Girls

Grades 6-12
Publisher: Stenhouse Publishers
Toll-free: (888) 363-0566
$18.50

Written by teacher researchers from throughout the country, this book offers practical strategies for changing the curriculum and building communities that are designed to help teen and preteen girls grow up secure and strong. Using stories of their own classrooms, the writers show how their beliefs and actions changed as they watched and listened to their female students. ENC-015403

Educating Immigrant Children: What We Need to Know to Meet the Challenges

Grades PreK-12
Publisher: Corwin Press, Inc.
(805) 499-9774
$24.95

The goal of this book is to improve the education of immigrant students by helping educators understand diverse cultural backgrounds, clarify their own racial and ethnic attitudes, and develop appropriate pedagogical knowledge and skills. Through these processes the authors hope to create a forum for dialogue at all levels (local through international) that addresses issues of multicultural equity. ENC-015815

Educating Children with Multiple Disabilities: A Transdisciplinary Approach

Grades PreK-12
Publisher: Paul H. Brookes Publishing Co.
(800) 638-3775
$38.00

This resource book, intended for educators, health care professionals, and parents, presents strategies for working with students with mental retardation and motor or sensory impairments in an inclusive education environment. Included are curricular and instructional adaptations that aim to transform intervention challenges into learning opportunities. ENC-016888

American Indian Stereotypes in the World of Children: A Reader and Bibliography

Grades K-12
1999
Publisher: Scarecrow Press, Inc.
(800) 462-6420
$32.50

The editors of this book compiled these articles to "shock adults into realizing that the world of contemporary American infants and young children is saturated with inappropriate images of Indians." The book's goal is to incite readers to remove the racist images and fill the historical omissions in books, toys, and popular culture. It discusses the effects that the negative images have on both the Native American children's self-esteem and the non-Native American children's ability to relate to them. ENC-017192

Equity and Science Education Reform

Grades K-12
2000
Publisher: Lawrence Erlbaum Associates Inc.
(800) 926-6579
$29.95

Based in part on a series of nine background papers commissioned by the American Association for the Advancement of Science's Project 2061, this book is intended to stimulate thinking and discussion about equity issues and science education reform as well as to direct the reader to the research and policy base. ENC-017166

Educating Homeless Students: Promising Practices

Grades K-12
2000
Publisher: Eye On Education
(914) 833-0551
$39.95

This book was written to help educators and other community members address the complex realities of homelessness for children and youth. The text provides an appraisal of the challenges

faced by homeless families and describes some creative solutions for education developed by individuals and organizations in diverse communities. ENC-017193

Reaching Out: Best Practices for Educating Mexican-Origin Children and Youth

Grades K-12
Publisher: Appalachia Educational Laboratory, Inc.
(800) 624-9120
$24.00

The first chapter of this book presents some characteristics of the first- and second-generation Mexican immigrant school population and their implications for improving educational practice. Subsequent chapters examine the issues and challenges affecting first- and second-generation Mexican origin children from the perspectives of culture, language, gender, family/community, and social and political factors. ENC-017013

Distinguished African American Scientists of the 20th Century

Grade 7 and up
1996
Publisher: Oryx Press
(800) 279-6799
$54.95

The 100 biographical sketches in this book cover men and women from George Washington Carver to Dr. Mae Jemison. The people are well known for their contributions in mathematics, science, engineering, and medicine. The list is not meant to be a comprehensive list, but a cross-section of distinguished African American participation in scientific professions. ENC-017271

Minorities in Science

Grades 4-12
Publisher: CSY, Inc.
Toll-free: (800) 352-0477
$1995.00 per kit. Kit includes 6 laserdiscs, 6 texts, 6 posters, 1 CD-ROM and 1 activity book.

This kit is designed to motivate and enliven science through the words and images of six contemporary minority and women scientists. It integrates a discussion of the scientists' personal stories with scientific principles related to their disciplines through biographies, conversations, and interactive science simulations using print, laserdisc, and computer media. ENC-015943

Teaching and Learning Mathematics in Poor Communities

www.nctm.org/about/committees/rac/tfpc/

Grade PreK and up
1999

Available online, this NCTM Task Force report from a 1998 working conference addresses issues related to poverty and the teaching and learning of mathematics. The report highlights issues that include teaching conditions, the impact of assessment and standardized testing, economic implications, and the effects of curriculum policies. ENC-017463

The Pedagogy of Poverty Versus Good Teaching

Series: Phi Delta Kappan
equity.enc.org/equity/eqtyres/erg/111376/1376.htm

Grades K-12
1991
Author: Martin Haberman

This article presents the author's observations on the standard form of teaching that has become the accepted style in urban classrooms, standard teaching acts he calls the pedagogy of poverty. The article discusses the constituencies to whom this pedagogy of poverty appeals. The author explores the nature of urban children and youth, as well as reform in urban schools. ENC-009654

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