

Preparing Women and Minorities for Science and Engineering: Resources for Educators, Parents, and the Community

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The training, entry, and persistence of women and minorities in science and engineering are determined by a complex set of inter-related social and economic factors. These include family acceptance and encouragement, early and continued training in mathematics and science and their pre-requisites, a supportive educational environment, science training that engages students and relates to their interests, availability of role models and mentors, assistance in designing education and career paths, adequate financial resources, collegial employment settings, and commitment by the larger community.

Educators, parents, and members of the community play critical roles.

This compilation lists and annotates readily accessible materials that educators, parents, administrators, and community leaders can use in locating and building strategies and programs to **facilitate preparation of girls and minority students in middle and high schools for eventual careers in science, technology, engineering, and mathematics (STEM)**. Many useful sources exist. Not all could be included here. Preference in selection was given to items that are freely available over the Internet and provide multiple links to additional information.

Comments, suggestions, or corrections are invited. Please send them to el.collinsREMOVETHIS@verizon.net.

Links to resources for teaching and learning, mentoring, parental support, and community involvement are listed under seven headings:

- (1) Women in STEM
- (2) Minorities in STEM
- (3) Education Resources
- (4) STEM Education Resources
- (5) Planning Education and Career Paths
- (6) Technology in Education
- (7) Ensuring Kids' Safety on the Internet

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(1) Women in STEM

Association for Computing Machinery (ACM) Special Interest Group on Computer Science Education (SIGCSE), *Women and Computing*, Special Issue of the SIGCSE Bulletin "Inroads," Volume 34, Number 2, June 2002. This special edition provides an overview of women's participation in computer science, the complex set of factors that determine girls' and women's entry and persistence in computer science, and strategies that can be used by schools, employers, families, and communities to increase women's preparation for and participation in the field. Extensive references and web links are given. Order form can be downloaded from the publications page at <http://www.acm.org/sigcse/>. Paper copy is \$6.50 plus \$7 for shipping and handling (\$9 outside North America).

National Academies, National Academy of Engineering. Engineer Girl! <http://www.engineergirl.org/nae/cwe/egmain.nsf/?Opendatabase> provides information and links to help girls figure out what engineers do, whether they would like to enter engineering, and how they can prepare for a career in engineering plus examples of successful women engineers. The companion site **Celebration of Women in Engineering** <http://www.nae.edu/nae/cwe/cwemain.nsf> offers resources and links for parents, teachers, and other mentors who want to encourage girls in math and science and pursuit of engineering careers. The inter-linked sites are part of the National Academy of Engineering effort to encourage increased participation of women in engineering.

National Academies, Committee on Women in Science and Engineering web site <http://www4.nationalacademies.org/osep/cwse.nsf> posts studies of women in science and engineering and how to increase their participation. Publications include ***From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers*** (2001) www.nap.edu/catalog/5363.html Reports can be purchased or read online.

National Council for Research on Women, *Balancing the Equation: Where Are Women and Girls in Science, Engineering and Technology* (2001) by Mary Thom. This report analyzes the extent to which women and girls have progressed in science, engineering, and technology over the last two decades. It reviews programs that successfully increase STEM participation of girls, women and minorities and "finds that women and girls excel in environments that encourage hands-on research, include mentoring and role models, and link science, technology and engineering to other disciplines and real world applications." The report discusses the need for cultural and institutional change and provides resources to "help educators, business leaders and policy makers promote women's and girls' advancement in the sciences." The full report can be ordered on the NCRW site <http://www.ncrw.org/> for \$22.00, less 20% discount

for NCRW affiliates, and plus \$4.50 postage and handling. The press release, executive summary and selected excerpts are available for free on the site <http://www.ncrw.org/>. The site also includes Web links for science programs for K-12 education, including in-school and after-school and summer activities, professional development for teachers, and curriculum development and assessment.

National Science Foundation, Education and Human Resources Directorate, *New Formulas for America's Workforce: Girls in Science and Engineering* (2003). This book summarizes methods and results from 211 NSF grants on making science and technology more accessible to girls in K-12. It is written in lay person's terms for educators, parents and professionals. Chapter 1 provides techniques for engaging learners in the classroom or in informal settings, such as after-school or summer programs and museums. The techniques include hands-on activities, working in cooperative teams, looking at real-world contexts with a scientific eye, confidence building through problem-solving, and exposure to working scientists and engineers. Chapter 2 offers techniques that can be used by teachers, counselors, parents, mentors, and, volunteers to create a social support system that encourages students to undertake science and mathematics. Chapter 3 reports experiments in science and mathematics course design to appeal to a broad base of students, especially girls. The course designs have been tested in actual school settings and their effectiveness evaluated. Chapter 4 considers techniques for addressing multiple diversities, such as learning English and science, living in a remote rural area and learning science, living in an inner city and learning science, or learning science while having limited opportunities and finances. Chapter 5 discusses strategies for reaching "all 'parts of the system'—the people (students, teachers, parents, counselors, administrators, faculty, mentors and industry role models), the pedagogy (how material is taught), the course content (what is taught, when), and organized social support networks." The book includes contacts, references, Web links, and addresses for software downloads. It is available online <http://www.nsf.gov/pubs/2003/nsf03207/start.htm>, in print (NSF 03-207) and on CD (NSF 03-208)—all free. Press release (NSF PR 03-92) and links to ordering page are at <http://www.nsf.gov/od/lpa/news/03/pr0392.htm>.

(2) Minorities in STEM

BEST (Building Science and Engineering Talent) www.bestworkforce.org is a workforce initiative of the Council on Competitiveness <http://www.compete.org/>. BEST is a public-private partnership created in September 2001. It seeks to "bring together the nation's most respected practitioners, researchers and policymakers to identify what's working across the country to develop the technical talent of under-represented groups in pre-K through 12, higher education, and the workplace. No comprehensive assessment on this scale has ever been attempted. Its completion will enable BEST to establish itself as the

nation's leading hub for sharing insights into best-in-class programs across the country." Initial reports (in particular, ***The Quiet Crisis: Falling Short in Producing American Scientific and Technical Talent***) can be downloaded free from the BEST site. A set of links is under construction as of 10/7/2003.

The Education Trust www.edtrust.org seeks systemic reform of the K-16 education system so that schools and colleges work for all of the young people they serve and that all students in all K-16 grades learn at high levels (including in particular, low-income students and students of color). Their web site provides research findings and practical materials for use by parents, teachers, community activists, and local and national leaders. Much of it can be downloaded for free.

National Academies; Behavioral, Cognitive, Sensory Sciences, and Education (BCSSE); *Achieving High Educational Standards for All: Conference Summary*; Timothy Ready, Christopher Edley, Jr., and Catherine E. Snow, Editors (2002). "This volume summarizes a range of scientific perspectives on the important goal of achieving high educational standards for all students. Based on a conference held at the request of the U.S. Department of Education, it addresses three questions: What progress has been made in advancing the education of minority and disadvantaged students since the historic *Brown v. Board of Education* decision nearly 50 years ago? What does research say about the reasons of successes and failures? What are some of the strategies and practices that hold the promise of producing continued improvements? The volume draws on the conclusions of a number of important recent NRC reports, including ***How People Learn, Preventing Reading Difficulties in Young Children, Eager to Learn, and From Neurons to Neighborhoods***, among others. It includes an overview of the conference presentations and discussions, the perspectives of the two co-moderators, and a set of background papers on more detailed issues." Can be read free online or hard copy can be purchased <http://www.nap.edu/catalog/10256.html>

National Action Council for Minorities in Engineering (NACME) <http://www.nacme.org> provides "leadership and support for the national effort to increase the representation of successful African American, American Indian and Latino women and men in engineering and technology, math- and science-based careers." There is a ***For Pre-College Students*** <http://nacme.org/precollege/> section at the NACME web site that offers resources and web links for students, parents, and educators for deciding about, planning, and preparing for a career in engineering. NACME also offers a "one-stop shopping" career counseling ***Guide Me*** site www.guidemenacme.org with over 1000 links oriented to students of color, parents, educators, and employers.

Quality Education for Minorities (QEM) Network <http://gemnetwork.gem.org/> offers information for parents and teachers' use with students, administrators, and political leaders to improve the education of African Americans, Alaska

Natives, American Indians, Mexican Americans, and Puerto Ricans. The site includes **Parents Information Network** <http://gemnetwork.gem.org/PIN.html>.

(3) Education Resources

Educational Resources Information Center (ERIC) <http://www.eric.ed.gov/> is a federally funded, nation-wide information network of education literature. The ERIC database contains “more than 1 million bibliographic records of journal articles, research reports, curriculum and teaching guides, conference papers, and books. Each year, approximately 32,000 new records are added.” It is part of the **U.S. Department of Education’s National Library of Education** and consists of 16 subject-specific clearinghouses, 10 adjunct clearinghouses, one affiliate clearinghouse, and additional support components. ERIC includes information about best practice in areas such as teaching with technology, professional development, teacher mentoring, and lesson plans; information for use in school administration and whole-school reform; and information for parents such as student development, parental involvement, how to help children with school transition, and helping disabled or gifted children.

MarcoPolo: Internet Content for the Classroom <http://www.marcopolo-education.org> “is a consortium of premier national education organizations, state education agencies and the MarcoPolo Education Foundation dedicated to providing the highest quality Internet content and professional development to teachers and students throughout the United States.” It was “launched in 1997 as a collection of standards-based, discipline-specific educational Web sites for K-12 teachers.” It features “seven content Web sites with lesson plans, student interactive content, downloadable worksheets, links to panel-reviewed Web sites and additional resources created by the nation’s leading education organizations, a scalable professional development program..., a network of 50 states plus the District of Columbia dedicated to rolling out MarcoPolo to all teachers and aligning the content to state education standards,” and “leading edge diagnostic measurement and technology that enables state-of-the-art tracking and reporting to ensure that teachers’ Internet integration needs are being met across the country.

National Academies, Board on Testing and Assessment

<http://www7.nationalacademies.org/bota/> provides scientific information for policymakers and the public about critical issues of testing and assessment in education, the workplace, and the armed services. Their projects and reports (available free online or for a charge in paper) address questions and provide guidance about judging “the technical qualities of tests and assessments and the intended and unintended consequences of their use.”

National Academies, Center for Education

<http://www7.nationalacademies.org/cfe/> aims to make research findings available

for practitioners, parents, community members and policy makers for improvement of education of all Americans. Their projects and reports (available free online or for a charge in paper) address critical education issues--including standards, teaching, technology, preparation of youth for productive futures, and the improvement of educational research.

North Central Regional Educational Laboratory <http://www.ncrel.org/> provides research-based resources for teachers and policy makers, including resources for science and math.

SBC Knowledge Network Explorer, Blue Web'N

<http://www.kn.pacbell.com/wired/bluewebn/> is an "online library of 1800+ outstanding Internet sites categorized by subject, grade level, and format (lessons, activities, projects, resources, references, & tools)." Searches can be done by grade level, broad subject area, or specific sub-categories.

(4) STEM Education Resources

American Association for the Advancement of Science (AAAS)

<http://www.aaas.org/> **Education and Human Resources** branch <http://ehrweb.aaas.org/> provides information and materials for students, teachers, parents, and community members and leaders in support of improved STEM education for all including women, minorities, and people with disabilities <http://ehrweb.aaas.org/CareersAll/index.htm>. AAAS maintains a news page for parents and teachers <http://www.aaas.org/press/kids/>, a science news page for children <http://www.eurekaalert.org/kidsnews/>, and information and links for parents <http://www.tryscience.org/parents/parent.html>.

Educational Resources Information Center Clearing House for Science, Mathematics, and Environmental Education (ERIC/CSMEE)

<http://www.ericse.org> provides resources and links for science, mathematics, and environmental education, in school or out of school. It is part of the Federally-funded ERIC system and is located at **Ohio State University**.

Eisenhower National Clearinghouse for Mathematics and Science

Education (ENC) <http://www.enc.org/> maintains a comprehensive collection of mathematics and science curriculum resources; supports teachers' professional development in math, science, and the effective use of technology; and provides free products and services for all K-12 educators, parents, and students with free products and services. The web site allows targeted search of curriculum resources by resource type, grade level, and other features <http://www.enc.org/resources/search/advanced/>. ENC is located at **Ohio State University** and is funded by the **U.S. Department of Education**.

GLOBE <http://www.globe.gov/fsl/welcome.html> “is a worldwide hands-on, primary and secondary school-based education and science program ... For Students, GLOBE provides the opportunity to learn by taking scientifically valid measurements in the fields of atmosphere, hydrology, soils, and land cover/phenology - depending upon their local curricula; reporting their data through the Internet; creating maps and graphs on the free interactive Web site to analyze data sets; [and] collaborating with scientists and other GLOBE students around the world. For Teachers, GLOBE provides assistance through training at professional development workshops; teachers’ guides, “how-to” videos, and other materials, continuing support from a Help Desk, scientists, and partners; [and] contact with other teachers, students, and scientists worldwide. For international and U.S. Partners, GLOBE provides train-the-Trainer workshops [and] guidance and support for mentoring teachers... GLOBE is a cooperative effort of schools, led in the United States by a Federal interagency program supported by NASA, NSF, EPA and the U.S. State Department, in partnership with colleges and universities, state and local school systems, and non-government organizations. Internationally, GLOBE is a partnership between the United States with over 100 other countries.”

National Academies, Committee on Programs for Advanced Study of Mathematics and Science in American High Schools, *Learning and Understanding: Improving Advanced Study of Mathematics and Science in U.S. High Schools* <http://books.nap.edu/catalog/10129.html> (2002) addresses preparation for advanced study in middle grades, improvements in advanced study programs, and making them available to more students, especially minorities and those attending rural and inner-city schools. Issues of access and equity are considered at length (including: “they can have a profound impact on other components of the education system and participation in the programs has become key to admission at selective institutions of higher education.) Can be read free online or purchased in paper.

National Academies, Committee on Science Education K-12 promotes standards-based reform of science education for all pre-college students. It produces studies and publications for diverse audiences; serves as a clearinghouse for issues in science education reform; cooperates with professional and scientific societies to promote science education reform; provides leadership in the use of standards, and recommends improvements in science education. Reports can be read free online or paper copies can be purchased. <http://www7.nationalacademies.org/cose/> . Included is ***Inquiry and the National Science Education Standards: A Guide for Teaching and Learning*** (2000) <http://books.nap.edu/catalog/9596.html>. It presents a practical guide to teaching across the range of science topics in K-12 using the methods of scientific inquiry recommended by the ***National Science Education Standards*** (1995). ***The Guide*** “shows how to bring the standards to life, with features such as classroom vignettes exploring different kinds of inquiries for elementary, middle, and high school and Frequently Asked

Questions for teachers, responding to common concerns such as obtaining teaching supplies.” The book discusses assessment of students’ achievements, administrative assistance, communication with parents, teacher evaluation, and other mechanisms for supporting inquiry based science teaching science teaching.

National Academies, Mathematical Sciences Education Board

<http://www7.nationalacademies.org/MSEB/index.html> provides information in support of improved mathematics education at all levels and for all members of our society. Their current initiatives “focus on the learning, instruction, and assessment of mathematics; equity in mathematics; attracting and retaining students in mathematics majors and in mathematically intensive careers; capacity building and professionalization of mathematics education; evidence of effectiveness in mathematics education; and the public perception of mathematics, mathematics learning, and mathematics teaching.” Reports include ***Adding It Up: Helping Children Learn Mathematics*** (2001) <http://books.nap.edu/catalog/9822.html> which “explores how students in pre-K through 8th grade learn mathematics and recommends how teaching, curricula, and teacher education should change to improve mathematics learning during these critical years.” Also available is ***Helping Children Learn Mathematics*** (2002). The latter is an abridged version of ***Adding It Up*** for teachers and parents. Reports can be read free or purchased in paper online.

National Academies, National Committee on Science Education Standards and Assessment, *National Science Education Standards* (1995) identifies

what all students, regardless of background or circumstance, should be able to do and understand at different grade levels in various science categories. It considers the exemplary practice, criteria for assessing and analyzing students’ attainments in science and the learning opportunities that school science programs afford; the nature and design of the school and district science program; and the support and resources needed for students to learn science. The book reflects “the principles that learning science is an inquiry-based process, that science in schools should reflect the intellectual traditions of contemporary science, and that all Americans have a role in improving science education.” It is addressed to education policymakers, school system administrators, teacher educators, individual teachers, and concerned parents.” Reports can be read free or downloaded online or purchased in paper at <http://nap.edu/catalog/4962.html>.

Illuminations <http://illuminations.nctm.org> is a partnership of the **National Council of Teachers of Mathematics** and the **MarcoPolo Education Foundation**. It offers resources to help improve the teaching and learning of mathematics for all students in K-12. The resources are standards-based and follow NCTM principles and standards for school mathematics.

National Science Digital Library <http://nsdl.org> is a digital library of exemplary resource collections and services, for teachers and learners, in support of STEM education at all levels, funded by the National Science Foundation.

National Science Resources Center (NSRC) <http://www.si.edu/nsrc/> “collects and disseminates information about exemplary teaching resources, develops and disseminates curriculum materials, and sponsors outreach activities, specifically in the areas of leadership development and technical assistance, to help school districts develop and sustain hands-on science programs.” It is operated by the **National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, and the Smithsonian Institution.**

National Science Teachers Association (NSTA) <http://www.nsta.org/> promotes excellence and innovation in science teaching and learning for all. Their web site provides information and materials for science teachers, science supervisors, administrators, scientists, and parents. It includes searchable reviewed links to Web content related to key textbook passages.

Physical Sciences Resource Center <http://www.psrc-online.org/> offers Internet links for teachers and students in the physical sciences from K-20. Materials are classified by grade level, topic, and activity type; and information is provided about content, authors, publishers, costs, and copyrights. Included are “curriculum materials for all grade levels, classroom demonstrations, labs, online learning material, evaluation instruments, and articles about approaches to science education. The collection can be searched by keyword and author's name and organization, or browsed by topic, type of resource, or grade level.” The Center is a service of the **American Association of Physics Teachers** and is supported, in part, by the National Science Foundation and the **American Physical Society** Campaign for Physics.

Science Net Links <http://www.sciencenetlinks.com/> is a partnership of **American Association for the Advancement of Science** and the **MarcoPolo Education Foundation** that provides resources for K-12 science educators. At its core are “standards-based lesson plans that incorporate reviewed Internet resources, and can be selected according to specific benchmarks and grade ranges. Each lesson is tied to at least one learning goal and uses research-based instructional strategies that support student learning. The lessons are written for the teacher, but include student-ready materials such as student sheets (student reproducibles) or E-Sheets (online worksheets that enable students to engage directly in Internet activities).” It presents Web resources that have been reviewed according to stated criteria and that can be sorted by specific education benchmark areas and grade ranges. “To help educators integrate Science NetLinks resources into a standards-based curriculum, all site content is organized around Benchmarks for Science Literacy. These benchmarks are a set of science literacy goals developed by Project 2061, AAAS's long-term initiative to reform K-12 science education nationwide.”

(5) Planning Education and Career Paths

Students.gov <http://www.students.gov/STUGOVWebApp/index.jsp> is the "student gateway to the U.S. government." It includes information on planning and paying for school, tax provisions affecting students, budgeting, career development, and job search.

U.S. Department of Education NCES IPEDS College Opportunities Online <http://nces.ed.gov/ipeds/cool/> contains links to nearly 7000 colleges and universities (large universities, small liberal arts colleges, specialized colleges, community colleges, career or technical colleges, and trade schools). Includes search capability to sort by geographic and other characteristics.

U. S. Dept of Treasury, Federal Financial Education Resources <http://www.treas.gov/offices/domestic-finance/financial-institution/fin-education/resources/index.html> includes information and curricula about savings, home ownership, credit management, and retirement planning.

(6) Technology in Education

Distance-Educator.com web site <http://distance-educator.com/> and free newsletter available through the site provide alerts and links to new data and research about distance education.

National Academies, Center for Education and Computer Science and Telecommunications Board, *Planning for Two Transformations in Education and Learning Technology: Report of a Workshop* (2003) assesses potential of technology in education and identifies steps needed to reach it. Can be read online for free or hard copy can be purchased http://www.nap.edu/catalog/10789.html?onpi_listserv081503.

Educational Resources Information Center Clearing House on Information & Technology (ERIC/IT) <http://www.ericit.org/> provides research-based information and links for teachers, librarians, administrators, and others about the use of technology in education. It is part of the Federally-funded ERIC system and is hosted by the Information Institute of Syracuse at Syracuse University.

(7) Ensuring Kids' Safety on the Internet

National Academies, "NetSafeKids" draws information from "Youth, Pornography, and the Internet" (National Academies 2002), reviews Internet safety issues for parents and educators, and suggests strategies for addressing the issues. Free online at <http://www.netsafekids.org>.