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ABSTRACT

Many of the National Science Foundation-funded math curricula offer (or will be offering) staff development workshops to accompany the adoption of the curricula in schools and districts. While much of this staff development focuses on providing teachers with a solid grounding in the mathematical content of the curricula, an opportunity exists within these efforts to incorporate equity in a substantive way. As part of the Weaving Gender Equity into Math Reform project, we hope to provide teachers, administrators, staff developers, and others with the tools to implement themes and practices related to equity in their professions. Our project is focusing on how issues of gender, ethnicity, socioeconomic status, and language play out in the elementary reform math classroom. We plan to capitalize on staff development geared toward teachers new to these curricula by "weaving" equity into the workshops and print materials. Other organizations have tackled equity in education through their research, writing, and activism. With all of the interest in the last ten years on equity in education, there exists a plethora of books, articles, and organizations devoted to the goal of a quality education for all. In an attempt to sort through all this information, several resource lists have been compiled that highlight some of the available materials. While many of these lists provide a lot of information on the broader themes of equity in education, few speak directly and pointedly to the issue as it relates to the elementary reform math classroom. With this in mind, we have created a resource guide slanted toward both staff developers and teachers that will provide information specific to equity not only in general terms but also in areas related to reform math. The Equity Resource Guide currently consists of five components: (1) an annotated list of relevant research articles and books; (2) an annotated list of organizations and projects of interest; (3) an annotated list of relevant Web sites and other electronic sources; (4) equity tools; and (5) a listing of equity workshops around the country. This guide is a work-in-progress. (Author/MM)

Weaving Gender Equity into Math Reform

Equity Resource Guide

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Introduction

Many of the NSF-funded math curricula offer (or will be offering) staff development workshops to accompany the adoption of the curricula in schools and districts. While much of this staff development focuses on providing teachers with a solid grounding in the mathematical content of the curricula, an opportunity exists within these efforts to incorporate equity in a substantive way. As part of the Weaving Gender Equity into Math Reform project, we hope to provide teachers, administrators, staff developers, and others with the tools to implement themes and practices related to equity in their professions. Our project is focusing on how issues of gender, ethnicity, socioeconomic status, and language play out in the elementary reform math classroom. We plan to capitalize on the staff development geared toward teachers new to these curricula by "weaving" equity in to the workshops and print materials.

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Print Resources

Education reform

Campbell, Patricia. (1996). **"Empowering Children and Teachers in the Elementary Mathematics Classrooms of Urban Schools."** *Urban Education*, Vol. 30 (No. 4), 449-475.

Project IMPACT offered a 22-day summer in-service program for teachers with predominantly minority students. IMPACT helped teachers work with the existin knowledge of their students, to frame instruction within meaningful contexts, to focus on problem solving, and to expect every student to engage in mathematical inquiry. Assessment results demonstrated higher achievement for students in the IMPACT treatment schools, particularly on items dealing with mathematical abstraction. In-school math specialists and supportive principals, along with the summer in-service program, contributed the efficacy of IMPACT.

Civil Rights Alert. (1999). **Testing: The Need and Dangers.** The Civil Rights Project - Harvard University. Available at: http://www.law.harvard.edu/civilrights/alerts/testing.html

High stakes testing can be beneficial to gauge academic performance and to subsequently motivate higher levels of achievement. However, such testing has also proven to be discriminatory and most damaging to the academic future of minority and low-income students. The Civil Rights Project conducted a study in which high stakes testing was found to be detrimental because they tend to penalize students - particularly minorities - rather than motivate them to reach higher levels of achievement. Legal avenues and steps to promote community activism are provided to protect the civil rights of minority students if it s believed that testing and school policy is hurting opportunities available to them.

Clinchy, Evans. (2001). **"Needed: A New Educational Civil Rights Movement."** *Phi Delta Kappan*, Vol. 82 (No. 7), 493-498. Available at: http://www.pdkintl.org/kappan/kcli0103.htm

The author describes the re-entrenchment of educational inequities based on several trends. He points to the resegregation of America's schools, the unrealistic vision of Goals 2000 coupled with its accountability measures, and retention policies as indicators of an education reform vision gone awry. He exposes the ties the business community has to elected officials in pushing this reform agenda. Clinchy concludes by proposing a new civil rights movement rooted in the United Nations' *Universal Declaration of Human Rights* which affords every person the right to an education, an education system supportive of multiple learning styles, and the ability of parents to make choices about their children's education.

Council for Basic Education. (2000). ***Closing the Gap: A Report on the Windspread Conference***. Available at: http://www.c-b-e.org/stclogap.htm

This conference identified four key components in successful education reform: helping every student reach high standards; improving educator capacity; accountability and assessment systems; and public will/community engagement. Some of the recommendations to come out of the conference include increasing teacher capacity in

instructional strategies, revisiting and revising standards, ending social promotion, implement an urban strategy, and focus resources on those students who need them most.

Cruz-Janzen, Marta. (2000). **From Our Readers: Preparing Preservice Teacher Candidates for Leadership in Equity."** *Equity and Excellence*, Vol. 33 (No. 1), 94-101.

The author sets the tone for this article by arguing that in order to support students of all backgrounds educators must address the whole human being rather than considering race, class, national origin, or gender in isolation. She urges teachers not to view multicultural education as something relating only to people of color, or as something that is "added on" to the curriculum. A key component of successfully tackling equity requires educators to look at their own experiences and socialization process.

Darling-Hammond, Linda. (1999). **"New Standards, Old Inequalities: The Current Challenge for African-American Education."** *The State of Black America 1999*. New York: National Urban League.

While many of the education reform efforts are worthwhile, standards and testing alone will not eliminate the long-standing disparities in education between White students and students of color. Investments in better teaching, curriculum, and schooling must accompany the new standards, rather than keeping in place the old system of educational inequality. Urban schools, which tend to be concentrated with Black and Hispanic students, must have access to standards-based curricula if they are expected to take state tests aligned with those curricula. Educators must address the structural inequities urban schools face - lower funding levels, fewer qualified teachers, and fewer materials and equipment.

Demmert, William. (1999). **"Personal Perspectives on Organizational Issues in the Standards-Based Education Movement."** in MCREL, *Including Culturally and Linguistically Diverse Students in Standards-Based Reform*. Available at: http://www.mcrel.org/products/diversity/roundtable.asp

High-quality instruction and a challenging curriculum do not stand as the sole answers to the question of how to achieve high standards for all students. Educators should also look at a framework consisting of six elements - equity, curriculum, teachers and administration, school environment and culture, school ownership and community support, and organizational issue. Several questions guiding this framework are: Do all students have access to quality instruction and full participation in the education system? Are minority perspectives and contributions recognized as part of the curriculum? Are teachers and administrators knowledgeable and supportive of the language and cultural base of the community?

Education Development Center, Inc. (1995). ***Equity in Education Series***. Newton, MA: WEEA Publishing Center. To order call: 1-800-225-3088.

This series of four pamphlets tackles various equity issues related to reform. Titles include: "School-to-Work Equitable Outcomes"; "Gender Stereotypes: The Links to Violence"; "Gender Equity for Educators, Parents, and Community"; and "Gender-Fair Math."

Eisenhower National Clearinghouse for Mathematics and Science Education. (1999). **"Ideas For Reform."** On-line. [http://www.enc.org/reform/]

With extensive links to reform-related articles and resources, this web site provides links to ENC's *Making Schools Work For Every Child*, the Teacher Change web project, information on TIMSS, and a list of reform-related articles. Included is an article by Mary Jo Powell titled "Equity in the Reform of Mathematics and Science Education," which explores ideas for infusing equity into school reform.

Elliott, Vivian and Sue Schiff. (2001). **"A Look Within."** *Journal of Staff Development*, Spring, 39-42.

In order to effect changes in teacher practice with regards to equity, staff developers must facilitate a process of personal exploration and transformation. Alongside the practice of new curriculum content and new strategies, teachers also consider the ways diverse learners' needs are being addressed. The authors cite informal reading inventories, writing assessments, scoring rubrics, and course enrollments as barometers for reflecting on classroom equity. Case discussions during workshops on particular student learning dilemmas provide another opportunity to examiner teachers' own stereotypes and expectations. Action research in looking at one's classroom can be guided by the following questions: Is my teaching culturally responsive? Are my attitudes and expectations responsive to cultural differences? Am I consistent, equitable, and individualized with each student? Questions to ask when evaluating a curriculum are also presented.

Fennema, Elizabeth, Thomas P. Carpenter, and Megan Franke. (1996). **"Cognitively Guided Instruction: A Knowledge Base for Reform in Primary Mathematics Instruction."** *The Elementary School Journal*, Vol. 97 (No. 1) 3-20.

Fennema, et al argue that Cognitively Guided Instruction provides an effective pedagogy for teachers to use in their mathematics classrooms. By centering on understanding students' thinking, CGI trains teachers on how to capitalize on the mathematical knowledge children bring to school and how use this in the constructivist classroom. Teachers reflect on their students' mathematical problem solving strategies, and use this as a basis for constructing their own instructional materials and practices.

Glass, Thomas E. (2000). **Where are all the Women Superintendents?** *The School Administrator, American Association of School Administrators (AASA).* Available at: http://www.aasa.org/publications/sa/2000_06/glass.htm

Although 72 percent of K-12 educators in this country are women, only 13.2 percent of superintendents are women. Based on 2000 Study of the American School Superintendency, AASA found that women are not in positions that typically lead to the superintendency and that they are not pursuing superintendent s credentials in preparation programs. It seems that women are not as experienced or interested in the district-wide fiscal management aspect of the position as men are. In addition, differences in gender roles indicate that the superintendency does not provide a balance between work and family life so that there is a personal preference to chose against the position. A strategy suggested to rectify the discrepancy in female representation is to change the nature of the position. This may be accomplished by reducing the administrative workload,

shifting fiscal management to the responsibility of an assistant superintendent, providing incentives to gain superintendent certification as well as rewarding districts and search firms for hiring women or minority superintendents.

Gross, Fred. (2000). **"Facing Equity: Facing Ourselves."** *Hands On!*, Vol. 23 (No. 1), 8-10. Available at: http://www.terc.edu/handson/handson.html

As an experienced facilitator of equity workshops for teachers and school administrators, the author reflects on the components of staff development necessary for instilling real change in practice. Gross points to the value in having educators reflect deeply about their own beliefs and biases as part of the change process. He cites activities such as confronting stereotypes and acknowledging the White, middle class behaviors teachers have in mind when they think of their ideal student as two ways to uncover bias. He ends by stressing the need to create a safe environment in which individuals can express their emotions and productively disagree with one another.

McNeil, Linda. (2000). **"Creating New Inequalities: Contradictions of Reform."** *Phi Delta Kappan*, Vol. 81 (No. 10), 729-734.

The Texas Assessment of Academic Skills (TAAS) test represents a shining example to many policy makers of a successful accountability system. However, the implementation of this high-stakes test has led to increasing inequalities between White students and students of color. When the TAAS was first given to students in Texas, scores for students of color were significantly lower than those for White students. The response of educators was to provide training to minority students to help give scores a boost. But since the test focuses primarily on basic skills, this prep time has resulted in students of color receiving instruction on remedial skills while White students benefit from more rigorous curriculum and instruction.

National Science Foundation. (1998). ***Infusing Equity In Systemic Reform: An Implementation Scheme***. Reston, VA: Author.

Intended to aid leaders of NSF Systemic Initiatives, this book outlines the issues involved in the pursuit of equity and excellence for all students. In addition to describing NSF's priorities in this area, it lists strategies for achieving equity, an assessment tool for schools and districts that measures how equitable they are, and a description of how to weave equity in to curriculum and instruction.

Nelson-Barber, Sharon. (1999). **"A Better Education for Every Child: The Dilemma for Teachers of Culturally and Linguistically Diverse Students."** in MCREL, *Including Culturally and Linguistically Diverse Students in Standards-Based Reform*. Available at: http://www.mcrel.org/products/diversity/roundtable.asp

Debunking the idea that "good teaching" in one cultural context may not transfer to another, the author looks at the intersection of standards-based reform and American Indigenous culture. Many practices found in standards-based reform - cooperative groups, hands-on learning, and real-world contexts - complement the cultures of many indigenous groups. Yet teachers may not be aware of other aspects of those cultures - long wait time before answering, nonverbal responses, and learning through

observation/direct experience - that are not necessarily addressed in the formal curriculum but which also influence student learning.

Oakes, Jeannie. (1990). ***Multiplying Inequalities: The Effects of Race, Social Class, and Tracking on Opportunities to Learn Mathematics and Science.*** Santa Monica, CA: The RAND Corporation.

Oakes looks at the question of whether "different types of students have different opportunities to learn science and mathematics." Students in high-ability tracks (which is largely White, Asian, and middle- and high-income students) are pushed to develop higher level thinking and problem solving skills, spend more time with hands-on activities, spend less time on "math facts," and have fewer quizzes and tests. Low-ability tracks, on the other hand, have more drill and practice, more worksheets, and more tests. Low-income students have less access to the best-qualified mathematics and science teachers and to quality classroom resources and facilities.

Oakes, Jeannie and Martin Lipton. (1994). **"Tracking and Ability Grouping: A Structural Barrier to Access and Achievement."** in Joan Goodland and Pamela Keating (Eds:) *Access to Knowledge: The Continuing Agenda for Our Nation's Schools.* New York: College Entrance Examination Board.

School and classroom tracking - which disproportionately places poor, Black, and Hispanic students in low- or average-ability classes - creates further disparities in achievement levels between those groups and non-poor, White students. Though arguments in support of tracking claim that children learn best with others of similar ability, the authors cite numerous studies that show high-ability students are not harmed by heterogeneous groupings while lower-ability students receive an inferior education when tracked. Furthermore, in tracked settings higher-ability students are taught abstract ideas, conceptual thinking skills, and problem solving methods, while students in lower tracks only receive instruction on basic mathematics and literacy skills. One step towards having successful mixed-ability classrooms is to utilize curricula that are organized around concepts and major themes, with lessons emphasizing complex thinking based in real-life contexts.

Sacks, Peter. (2000). **Predictable Losers in Testing Schemes.** *The School Administrator, American Association of School Administrators (AASA).* Available at: http://www.aasa.org/publications/sa/2000_12/sacks.htm

The dependence on high stakes testing to increase student performance levels has resulted in a cult of measurement in which testing has become synonymous with educational quality despite the fact that there is little evidence to support this. The use of tests to divide and discriminate against minorities is embedded in American history. A criticism of the accountability movement points to their failure to address discrepancies in test scores between rich and poor by looking at larger societal problems. Race and socio-economic background adversely predict performance on high stakes tests but high stakes accountability makes no attempt to address societal ills such as crime, poverty and racial inequity. School systems are at the mercy of social, political and business forces and cannot be viewed as separate entities in a controlled environment. Instead of reinforcing over-dependency on high stakes testing, there should be long term investments targeting

poor and minority communities to improve education resources with more money, smaller classes and pre-school programs.

Scott, Bradley. (2001). **"Coming of Age."** *IDRA Newletter*, Vol. 28 (No. 3), 6-9. Available at: http://www.idra.org/Newslttr/2001/Mar/Bradley.htm#Art3

Focusing on creating and implementing systemic equity, the underlying assumption in embarking on education reform is the right of every learner to receive a high quality public education. Areas of focus that come under this umbrella include a transformed curriculum, reformed professional development, technology equity, transformed views of teaching and learning, heightened educational stakeholder collaboration, parental involvement, safety in schools, and pre-K through college completion. The educational equity audit provided by the author offers a solid starting point for undertaking and evaluating systemic reform.

Sirotnik, Kenneth. (1994). **"Equal Access to Quality in Public Schools: Issues in the Assessment of Equity and Excellence."** in John Goodland and Pamela Keating (Eds.) *Access to Knowledge: The Continuing Agenda for Our Nation's Schools.* New York: College Entrance Examination Board.

Students are labeled and then sorted into educational tracks based on qualities such as *intelligence*, *achievement*, and *self-concept*. Yet these are abstract, human constructs that do not really measure how well one performs in school. The author discusses four working assumptions to guide his discussion on equity and excellence: (1) There are no systematic differences in human learning potential other than those attributable to individual variation itself. (2) Schooling environments can be created within which most students can achieve high levels of learning with a common curriculum. (3) A quality common curriculum does not need to be overly detailed so that it limits creative implementation at the local level. (4) Information on the quality of schooling should at least contain information on standardized achievement tests, educational conditions, and other qualitative and quantitative measures. The article concludes with a list of data which should be used by schools to assess equity and excellence in their institutions.

Solis, Adela. (2000). **"Equity Principles and School Reform: What it Takes to Ensure that 'All Means All'".** *IDRA Newsletter*, February. Available at: http://www.idra.org/Newslttr/2000/Feb/Adela.htm#Art2

The Improving America s Schools Act of 1994 calls for education reform, especially for low achieving children. While there are publications, procedures and criteria delineated for successful school reform, an equity component of reform has not been addressed so as to reach all students. There needs to be a clear articulation of the relationship between reform initiatives and the effort to eliminate discriminatory actions in schools. In order to embrace the concept of All Means All , the Intercultural Development Research Association (IDRA) seeks to promote equity in schools through its technical assistance services. Examples are provided for how IDRA has tackled this issue, including defining goals and conditions of equity and how to link equity to comprehensive school reform models and programs.

Swope, Kathy, and Barbara Miner, Eds. (2000). ***Failing Our Kids: Why the Testing Craze Won't Fix Our Schools***. Milwaukee, WI: Rethinking Schools, Ltd. To order call: 1-800-669-4192.

The contributors to this publication argue that the trend towards "accountability" in the form of high-stakes standardized testing damages public schooling and creates further inequities in education. Essays detail the history of standardized testing with its roots in the racist eugenics movement, the ways the testing trend has negatively impacted classroom practice, the political and business forces driving the push for more accountability, and the ways testing disenfranchises students of color and low-income students. Also included are alternatives to high-stakes tests, stories of parents and students taking action, and a list of state and national groups working on the issue.

Tate, William. (1995). **"School Mathematics and African American Students: Thinking Seriously About Opportunity to Learn Standards."** *Educational Administration Quarterly*, Vol. 31 (No. 3), 424-448.

The author looks at the appropriateness of opportunity-to-learn standards as an equity framework for supporting African American students' mathematical achievement. Opportunity-to-learn variables include content coverage, content exposure, content emphasis, and quality of instruction, and are designed to measure whether or not students are provided sufficient access to learn the material. One issue confronting school reform is the emphasis on teaching to standardized tests in classrooms with high percentages of African American students; this is particularly problematic when the tests emphasizes low-level skills. Another issue stems from fiscal inequities. Eighty percent of teachers of middle- to upper-class students received all or most of the materials they requested, compared to only 41% of teachers in schools with concentrations of poor students. Third, classroom content and practice is often disconnected from the experiences and traditions of African American students. These and other factors decrease such students opportunities-to-learn.

Vermont Institute for Science, Math and Technology. (1994). **"Equity Benchmarks for Vermont."** Randolph Center, VT: Author. Available at: http://www.vismt.org/pub/

VISMT's Equity Advisory Committee developed this list of equity benchmarks to guide school reformers in their efforts to improve learning for all students. The benchmarks cover areas such as curriculum, classroom climate, assessment, access to technology, and professional development. The third part of the document lists a six-point Equity Reality Check that invites administrators and teachers to assess the educational equity in their districts and schools.

Vermont Institute for Science, Math, and Technology. (1998). **"The Opportunity to Learn."** Available at: http://www.vismt.org/pub/

"How can my school work best for all students? How is technology related to equity? What are our students learning at school?" These are some of the guiding questions that this manual poses for parents and community members. Each question category presents background information, an example of an inequitable situation, things to consider, a more equitable scenario, and questions for parents about how their child's school is doing.

Weissglass, Julian, Ed. (1997). ***If Not Now, When? If Not Us, Who? Raising Equity Issues in Educational Settings***. Santa Barbara, CA: Center for Educational Change in Mathematics and Science. To order call: (805) 893-7722

This workbook contains a series of vignettes, essays, assessment tools, and perspectives designed to elicit discussion from educators concerned about equity in education reform. Definitions of equity are presented, as well as twelve perspectives on equity that provide a theoretical foundation for social change work. Question prompts, extensions, and suggestions for discussion methods/guidelines are also included.

Weissglass, Julian. (2000). **"No Compromise on Equity in Mathematics Education: Developing an Infrastructure."** in Walter Secada (Ed.) *Changing Faces of Mathematics:Perspectives on Multiculturalism and Gender Equity*. Reston, VA: National Council of Teachers of Mathematics

Advocates have numerous viewpoints regarding what equity means. Among these are that equity means: (1) access (2) proportional outcomes (3) equality (4) political change and (5) social, psychological, and institutional change. Unfortunately there currently exists no infrastructure for establishing equity as a part of the mathematics reform agenda. The author calls for a realignment so that equity becomes a central focus of the mathematics education reform movement. He then lays out twelve perspectives used during the Equity in Mathematics Education Leadership Institute (EMELI) that guide this work.

Wilgoren, Jodi. (2001). **Algebra Project: Bob Moses Empowers Students.** *New York Times*, January 7.

Acclaimed civil rights activist and mathematician Bob Moses developed the Algebra Project based on the theory that mastering algebra by the 8th grade will ensure access to college-prep curriculum, higher education and ultimately success in modern society. Acknowledging inequities in existing curriculum and access to math, methods used are culturally sensitive, contextual and geared toward low-income minority students. There is an emphasis to show students how math permeates everyday life. In Cambridge, MA, 92 percent of Algebra Project participants went on to take higher lever math courses in the 9th grade, which is twice the rate of their peers in the city. The reform includes a system in which teachers are trained with the 5-step philosophy of teaching that can be applied to any concept: physical experience; pictorial representation; people talk (your own words); feature talk (proper English); symbolic representation. Moses life works, legacy and current book *Radical Equations* are also discussed.

Zernike, Kate. (2000). **"Race-Ties Rating of Schools Poses Problem for Suburbia."** *New York Times*, May 9.

New York State Board of Regents decided to include how well Black and Latino students score on standardized tests as part of a school district's rating. This move will force schools to address gaps in achievement between White students and students of color that have persisted throughout the state. While many superintendents support the state in highlighting the achievement gap, they caution that systemic change requires time rather than quick fixes.

Learning Patterns

Anstett, Patricia. (2000). **"What Each Gender Finds Easy to Learn."** *Detroit Free Press*, June 6. Available at: http://www.freep.com/news/health/skills6_20000606.htm

In her study of girls' and boys' spatial skills, high school science teacher J. Gail Armstrong-Hall reveals four areas where girls tend to excel and four skills that more commonly develop among boys. The common spatial skills for girls are stationary targeting in cluttered fields; tracking using landmarks; visually aided mental movement of objects; and movement in one direction at a specific distance. Boys' strengths tend to lie in mobile targeting in uncluttered fields; tracking using sense of direction; imagined mental movement of objects; and abstract mental movement in any direction at any distance. Armstrong-Hall contends that these skills are innate, and that the skills typically found among boys are the foundation for higher math and science problem solving.

Boaler, Jo. (1998). **"Open and Closed Mathematics: Student Experiences and Understandings."** *Journal for Research in Mathematics Education*, Vol. 29 (No. 1), 41-62.

This study of two schools with alternative teaching approaches (one used traditional textbooks while the other used open-ended activities) shows that the students who learned mathematics in an open, project-based setting displayed more interest in math, became more flexible as mathematical thinkers, found math meaningful, and were more confident. There were also no gender differences in confidence and attitude among students in the project-based school, whereas girls in the more traditional school reported less confidence and enjoyment of math than boys did.

Bohlin, Carol Fry. (1994). **"Learning Style Factors and Mathematics Performance: Sex-Related Differences."** *International Journal of Educational Research*, Vol. 21 (No. 4), 387-397.

The major findings from this study of 421 high schools students include: (1) girls reported significantly less interest in technical careers than boys did and less confidence in their mathematical abilities; (2) high scores on the confidence scale were also correlated with high spatial abilities (or a relational learning style) - girls' lower confidence scores may explain their lower Geometry grades; (3) girls reported a greater desire for structure than boys did; (4) girls received higher grades than boys in Algebra I but lower PSAT-M scores; (5) high-structure students (e.g. many girls) often do well on teacher-made tests (where they solve problems like the ones modeled in class), but are at a disadvantage with standardized tests where creative thinking and intellectual risk-taking are required.

Carr, Martha and Donna Jessup. (1997). **"Gender Difference in First-Grade Mathematics Strategy Use: Social and Metacognitive Influences."** *Journal of Educational Psychology*, Vol. 89 (No. 2), 318-328.

This study found that girls were more likely to use overt strategies (counting on fingers or with counters), while boys were more likely to use retrieval (from memory) to solve

addition and subtraction problems. In the group sessions all children were more likely to use covert strategies (e.g. mental calculation) and retrieval.

Casey, M. Beth. (1996). **"Understanding Individual Differences in Spatial Ability Within Females: A Nature/Nurture Interactionist Framework."** *Developmental Review*, Vol. 16, 241-260.

Researchers in this study demonstrated that girls' mental rotation ability was a product of both their genetic makeup (nature) and their prior spatial experiences (nuture). Mental rotation ability was then linked to SAT-M performance, with higher scores for females being significantly correlated to higher mental rotation ability (no similar correlation was discovered for boys).

Catsambis, Sophia. (1994). **"The Path to Math: Gender and Racial-Ethnic Differences in Mathematics Participation from Middle to High School."** *Sociology of Education*, Vol. 67, 199-215.

Results from this study of eighth and tenth grade students show that both White and female students have greater opportunities to learn mathematics than students of color based on enrollment in high-ability classes. Females, especially African American and Latina students, are less likely to pursue math and science careers than their male peers. More Latina and White females report being afraid to ask questions in math class than male students. Tenth grade female students, especially young Latinas, tended to have less confidence than males did in their mathematical ability, with fewer gender differences found among African Amercians. A higher proportion of female students claimed to have taken math courses because they were required to, rather than out of choice; this difference was strongest among Latinos. For male and female African American students limited exposure to learning opportunities and low levels of achievement stood out as the greatest barriers to mathematics participation.

Dillow, Karen, Marilyn Flack, and Francine Peterman. (1994). **"Cooperative Learning and the Achievement of Female Students."** *Middle School Journal*, Vol. 26 (No. 2), 48-51.

This article pulls together several studies related to gender and cooperative learning. Current research shows that girls in middle and high school benefit from cooperative learning, particularly when they are paired with other female students. Females in cooperative groups scored higher on achievement tests than those working alone. Another study revealed that females with an internal locus of control (view themselves as influencing outcomes) do better when paired another female during a cooperative task and a male during a competitive task (rather than with a male during a cooperative task and a female during a competitive task).

Dreyden, Julia I. and Shelagh A. Gallager. (1989). **"The Effects of Time and Direction Changes on the SAT Performance of Academically Talented Adolescents."** *Journal for the Education of the Gifted*, Vol. 12 (No. 3), 187-204.

Researchers found discrepancies in student performance on the SAT-M test depending on if the test was administered as timed or untimed. All students scored higher on untimed tests versus when they were timed, with females experiencing the largest gain in

achievement. While the scores of untimed females were similar to those of untimed males, timed males received much higher scores than timed females. This study suggests that time, not ability, may account for gender differences in SAT-M achievement.

Fennema, Elizabeth and Lindsay A. Tartre. (1985). **"The Use of Spatial Visualization in Mathematics by Girls and Boys."** *Journal for Research in Mathematics Education*, Vol. 16 (No. 3), 184-206.

In this analysis of middle school students' spatial visualization skills, researchers found that girls tended to use pictures more than boys did, though they were not as successful as boys in getting correct solutions. Students with a higher level of spatial visualization skills used those skills more often in problem solving than those with a lower level of skill. While being low in spatial visualization did not negatively impact boys' math achievement, it did impair girls' performance.

Fennema, Elizabeth, Thomas Carpenter, Victoria Jacobs, Megan Franke, and Linda Levi. (1998). **"A Longitudinal Study of Gender Differences in Young Children's Mathematical Thinking."** *Educational Researcher*, Vol. 27 (No. 5), 6-11.

This study of children's problem solving abilities revealed gender differences in strategy use. Girls (grades 1-3) tended to use modeling or counting strategies (i.e. traditional algorithms), while boys tended to use more abstract strategies such as invented algorithms or derived facts. Boys and girls were equally successful at using invented strategies, and individuals who did chose to use invented algorithms were more successful on extension problems than those who utilized more traditional methods.

Fuchs, L., D. Fuchs, S. Kazdan, K. Karns, M.B. Calhoon, C. Hamlett, and S. Hewlett. (2000). **"Effects of Workgroup Structure and Size on Student Productivity during Collaborative Work on Complex Tasks."** *The Elementary School Journal*, Vol. 100 (No. 3), 183-212.

This study analyzed the relationship between workgroup size and structure on third- and fourth-grade students' achievement. Findings show that pairs (vs. small groups) promoted participation, helpfulness, cooperation, and higher quality of discussions for students from all ability levels. Lower-achieving students in particular benefited from dyads through increased participation and collaboration. On the whole lower-achieving students participated less than others in small groups and showed lower-quality procedural and conceptual talk. High-achieving students, on the other hand, worked more productively and effectively, and generated greater cognitive conflict, when paired with other high-achievers.

Garrison, Leslie. (1997). **"Making the NCTM Standards Work for Emerging English Speakers."** *Teaching Children Mathematics*, Vol. 4 (No. 3), 132-138.

Given that the NCTM Standards make mathematics instruction more language dependent, new strategies must be employed in the classroom in order to engage students whose first language isn't English. One teacher profiled selects a few in-depth problems rich with mathematical concepts so students can easily learn vocabulary in the context-rich problems. Another teacher asks students to share their problem solving strategies with each other, as those from other countries sometimes utilize procedures different from those used by U.S. students. Other strategies include: using other medium to

communicate mathematical concepts, such as with manipulatives, pantomiming, or visual aids; asking students to maintain math journals in their primary language; and allowing students to fill out assessment tasks in their primary language.

Gumperz, John, Jenny Cook-Gumperz, and Margaret Szymanski. (1999). ***Collaborative Practices in Bilingual Cooperative Learning Classrooms***. Washington, DC: Center for Research on Education, Diversity, and Excellence.

This research report looks at the shifting role of the teacher in cooperative learning environment from one of disseminator of information to a more facilitative approach. An underlying question guiding the work is: "What happens when students are left alone to work on classroom tasks?" This question is examined in the context of monolingual and bilingual classrooms.

Hayes, Lorrain & Curtis, Deborah. (2000). **The Impact of a Mathematics Summer Camp Program on Girls Spatial Visualization Skills and Career Aspirations in Mathematics and Engineering.** *College of Education Review*, Vol.1, Spring.

Engineering is a male-dominated field with women representing only %17 of engineering graduates. The idea that girls are not considering this career field due to lack of spatial visualization skills and lack of exposure to appropriate female role models led to the development of a summer program to address these issues. A summer camp was formed for sixth and seventh grade girls to increase their spatial visualization skills as well as their interest in pursuing careers in engineering. The program included spatial visualization exercises such as pentomino puzzles, and relevant guest speakers. Pretest and posttest assessments were administered to participating students to determine any significant changes in spatial visualization skills and career interests. In evaluating the program, it was discovered that by the end of the summer there was a significant change in career interest, with more than half of the participants indicating that they would consider engineering as a career choice.

Lubienski, Sarah Theule. (2000). **"A Clash of Social Class Cultures? Students' Experiences in a Discussion-Intensive Seventh-Grade Mathematics Classroom."** *The Elementary School Journal*, Vol. 100 (No. 4), 377-403.

This study of a seventh-grade Connected Mathematics Project (CMP - a Standards-based curriculum) classroom highlighted differences in communication styles between lower- and higher-socioeconomic status (SES) students. Lower-SES students expressed discomfort at participating in whole-class discussions unless they were certain they had the correct answer, while their higher-SES peers rarely voiced concerns about being wrong. Higher-SES students saw mathematical discussions as a chance to share their ideas and to be exposed to different ideas from others. Lower-SES students viewed their role in discussions as obtaining or giving right answer; they were less comfortable with debating ideas or reasoning through conflicting explanations. Lower-SES students tended to use "common-sense" reasoning that was closely tied to the context of the problem, while higher-SES individuals extrapolated problems to more abstract and generalized concepts. Lower-SES students also preferred a teacher-directed style in the classroom.

Lubienski, Sarah Theule. (2000) **"Problem Solving as a Means Toward Mathematics for All: An Exploratory Look Through a Class Lens."** *Journal for Research in Mathematics Education*, Vol. 31 (No. 4), 454-482.

This study of a Connected Mathematics Project (CMP) seventh-grade classroom looked at the socioeconomic status (SES) differences in students' reactions to learning mathematics through problem solving. Results showed that higher-SES preferred CMP to more traditional approaches, while lower-SES students favored the latter. Lower-SES students, particularly girls, favored having the teacher tell them mathematical rules, while their higher-SES peers were comfortable with minimal teacher direction. Lower-SES students showed a preference for the contextualized manner of many CMP problems, but failed to see the mathematical ideas connecting various problems; higher-SES students had more success in pulling out the mathematical ideas from contextualized problems. Girls of both levels were more diligent than boys at completing assignments. The amount of effort for higher-SES males and females, and lower-SES males, correlated with quiz and test results; for lower-SES girls though, despite consistent effort most did not do well on assessments.

Malloy, Carol and William Malloy. (1998). **"Issues of Culture in Mathematics Teaching and Learning."** *The Urban Review*, Vol. 30 (No. 3) 245-257.

Traditionally students have been expected to adapt to the dominant culture of classrooms in order to be academically successful. Reforms in mathematics have introduced inquiry-based learning, real-world problems, cooperative groups, and multicultural materials; yet culturally based pedagogy is still largely absent. Educators must be aware of the cultural learning styles of the children in their classrooms and tailor the teaching of mathematics to such styles. For example, research on the learning styles of African-American children has shown a preference for improvisational and intuitive thinking, informal class discussion, group achievement, extrinsic motivation, and a focus on the whole. This, combined with the shifts found in reform math classrooms, will enrich learning for all students.

Nelson-Barber, Sharon and Elise Trumbell Estrin. (1995). ***Culturally Responsive Mathematics and Science Education for Native Students***. San Francisco, CA: WestEd. To order call: (415) 565-3044.

This paper examines the current math and science reforms in terms of how they meet the needs of American Indian and Alaskan Native students. It argues that the constructivist pedagogy of reform math and science curricula must be informed by a sociocultural perspective that incorporates social and cultural systems as they relate to students' learning. The authors compare a Western approach to education and show how this directly conflicts with Native educational practices.

Tartre. Lindsay. (1990). **"Spatial Skills, Gender, and Mathematics."** in Elizabeth Fennema and Gilah Leder (Eds.), *Mathematics and Gender*. New York: Teachers College Press.

The author addresses the long-contended link between spatial skills and math achievement by looking at the do mains of spatial visualization (ment object) and spatial orientation (understanding a change in perspective while viewing an

object). Low spatial orientation (SO) female high school students showed substantially lower achievement than low-SO males and high-SO males and females. 80% of low-SO males who received a hint on how to solve the problem found the right answer; for low-SO females only 23% who received the hint answered correctly. The low-SO group of males had the highest mean of all groups for correct answers to visually presented problems. The author's conclusion is that higher spatial skills for males did not contribute to better achievement, but this pattern did hold more true for female students.

Webb, Noreen M. (1984). **"Sex Difference in Interaction and Achievement in Cooperative Small Groups."** *Journal of Educational Psychology*, Vol. 36 (No. 1), 33-44.

In analyzing interactions in cooperative small groups from a sample of seventy-seven junior high students, researchers found that females and males displayed similar patterns of interaction and achievement in groups with equal numbers of both sexes. In groups with more females than males, females asked the male student for help almost twice as often as they asked other females in the group. Male students tended to respond more to other males' request for help than to females' requests, particularly in groups with a gender imbalance. In majority-female and majority-male groups, males showed higher achievement than females did. The author's conclusion is that in coed cooperative groups girls benefit most when there is an equal number of males and females.

Willis, Sue. (1995). **"Mathematics: From Constructing Privilege to Deconstructing Myths."** In Jane Gaskell and John Willinsky (Eds.), *Gender In/forms Curriculum: From Enrichment to Transformation*. New York: Teachers College Press.

Some of the reasons for girls' lower confidence and interest in mathematics are discussed, such as girls being discouraged from risk taking, biased curriculum, and girls receiving a larger percent of criticism relating to their intellectual ability than boys do. After critiquing much of the biased mathematics curricula, the author launches into a discussion on the elements of a gender-inclusive curriculum. This kind of curriculum encourages students to share their mathematical thinking, work together in cooperative groups, take responsibility for their own learning, and go more in depth with problem solving.

Wilkinson, Louise Cherry, Janet Lindow, and Chi-Pang Chang. (1985). **"Sex Differences and Sex Segregation in Students' Small-Group Communication."** In Louise Wilkinson and Cora Marrett (Eds.), *Gender Influences in Classroom Interaction*. Wisconsin: Board of Regents of the University of Wisconsin System.

This sample of second- and third-grade coed small groups showed that boys' answers prevailed more often than girls' answers, even though both sexes ranked similarly in math achievement. Boys made more requests for action and information to other boys than to girls, while girls made an equal number of requests to both sexes.

Overview

American Association of University Women Educational Foundation. (1998). ***Gender Gaps: Where Schools Still Fail Our Children***. Washington, D.C.: Author. To order call: 1-800-225-9998 ext. 459.

Six years after the landmark *How Schools Shortchange Girls*, the AAUW revisits American schools to study how girls are faring. *Gender Gaps* contains the latest body of research on gender equity in the classroom, with recommendations for how to close the persisting gaps between girls and boys in public schools. The book reveals disparities between the types of mathematics classes boys and girls take, with girls less likely to enroll in advanced math courses in high school.

American Association of University Women Educational Foundation. (1992). ***The AAUW Report: Shortchanging Girls, Shortchanging America***. Washington, D.C.: Author. To order call: 1-800-225-9998 ext. 459.

This first in a series of AAUW reports looks at course taking patterns, classroom practice, standardized testing, and curricular bias, among other issues, in an effort to catalogue gender differences in education. After defining the ways that girls are dealt out of the educational system, the report offers forty strategies for decreasing disparities between boys and girls.

Bae, Yupin, Susan Choy, Claire Geddes, Jennifer Sable, and Thomas Snyder. (2000). ***Trends in Educational Equity of Girls and Women***. Washington, D.C.: U.S. Department of Education. Available at: http://nces.ed.gov/pubsearch/pubsin.

Starting in preschool and stretching on through post-secondary education, the statistics include measures of education achievement, psychological factors, involvement in after-school activities, course taking patterns, curriculum issues, and educational outcomes, among other things. While most of the indicators focus on differences between girls and boys, some break this down further to look at the differences between girls of various races.

Campbell, Patricia and Beatriz Chu Clewell. (1999). **"Science, Math, and Girls."** *Education Week*, Vol. 19 (No. 2), 50 and 53.

This look at the most recent statistics related to gender and math achievement shows disparities favoring boys in SAT-Math, NAEP, and AP scores. Boys received "advanced" and "proficient" scores at higher rates than girls on the NAEP, scored on average 35 points higher on the SAT-Math, and took more AP computer science and physics classes. Moreover, women are still underrepresented within some higher education fields, with on 17 percent of bachelor's degrees in engineering going to women. The authors caution that while girls have made gains in math achievement and participation, there is still a long way to go toward achieving full participation in science, mathematics, and engineering careers.

Campbell, Patricia and Edward Silver. (1999) ***Teaching and Learning Mathematics in Poor Communities***. Report from the Task Force on Mathematics Teaching and Learning in Poor Communities: National Council of Teachers of Mathematics. Available at: http://www.nctm.org

Answering to the growing number of children living in poverty and the current disparities in mathematics achievement between poor and non-poor students, the Task Force laid out some of the reasons for this disparity and suggested strategies for closing the gap. "Home atmosphere," lack of access to quality mathematics curriculum and instruction, teaching to standardized tests, and differences in mathematical content taught to students in poor versus non-poor classrooms were all cited as reasons for the disparities in achievement. Some methods for improving student learning in poor communities were: to provide better and more extensive teacher enhancement when implementing reform math curriculum; increase teachers' own mathematical content knowledge; use assessment as an impetus for implementing quality mathematics curricula; and provide students in poor schools with instructional approaches that emphasize a conceptual understanding of mathematics.

Campbell, Patricia and Jennifer Storo. (1994). **"Girls Are Boys Are : Myths, Stereotypes, & Gender Differences."** Washington, D.C.: U.S. Department of Education. Available at: http://www.campbell-kibler.com/

This pamphlet aims to debunk some of the myths regarding girls' and boys' achievement in math and science. It talks about the ways in which these myths (such as "real" women don't do math) play out within the educational system (girls who think of math as a "male thing" take fewer advanced classes) , and offers solutions for teachers and parents (challenge people who support this myth).

Cohen, Jody and Sukey Blanc. (1996). ***Girls in the Middle: Working to Succeed in School***. Washington, D.C.: American Association of University Women Educational Foundation. To order call: 1-800-225-9998 ext. 459

This AAUW report looks at how adolescent girls negotiate school, with a focus on how individuals girls made choices in complex situations. By studying what has worked in middle schools, this report indicates some of the strategies schools around the country have used to create an equitable learning climate.

Cole, Nancy S. (1997). ***The ETS Gender Study: How Females and Males Perform in Educational Settings***. Princeton, NJ: Educational Testing Service.

This national survey looked at the results of more than 400 different tests in a variety of subject areas for students in grades 4-12. In mathematics, gender differences grew larger as students moved to higher grades. Only minor differences appeared among fourth graders; by grade 12 boys scored higher on tests of math computation, math concepts, spatial skills, and mechanics/electronics.

College Board. (1999). ***Reaching the Top: A Report of the National Task Force on Minority High Achievement***. New York: College Entrance Examination Board.

Looking at the low numbers of African Americans, Latinos, and Native Americans among high achieving students, the Task Force set out to uncover some of the reasons why this disparity exists and to propose solutions to this issue. Students from low-

income homes and whose parents have little formal education (who tend to be disproportionately people of color) are much more likely to be low achievers. This trend will only worsen as the numbers of Latino and African American students whose parents don't hold a high school diploma is projected to grow. Another reason for low achievement is the high student mobility rate in schools serving large numbers of disadvantaged students. The report ends with recommendations for action for policy makers, educators, parents, and others.

Cooney, Thomas, Ed. (1990). ***Teaching and Learning Mathematics in the 1990s***. Reston, VA: National Council of Teachers of Mathematics.

Several chapters from this volume highlight some of the key issues in making mathematics accessible to all children. An article by Walter Secada calls out for the need to expose all students to more advanced forms of mathematics, to deal with the resegregation of schools, to counsel students of color to continue on in advanced math classes, and to include multicultural references in curricula. Lee Stiff describes the promise of the NCTM *Standards* for students of color by showing how the cultures of Latino, Black, and Asian groups fit in with many of the principles of the Standards. Gilbert Cuevas discusses strategies teachers can use to connect with language minority students, such as being familiar with each students' educational and cultural background, reviewing new terms several times, giving students many opportunities to talk about mathematics, and stressing reading and writing skills during math lessons. Brian Donovan points to the role of cultural power in defining how mathematics is taught and learned in school.

Cuevas, G. and M. Driscoll, Eds. (1993). ***Reaching All Students With Mathematics***. Reston, VA: National Council of Teachers of Mathematics. To order call: 1-800-235-7566.

With an eye toward NCTM's goal of making mathematics accessible to all students, this book focuses on strategies for including students from underrepresented groups in high quality learning. Particular attention is paid to students from diverse backgrounds who have traditionally been marginalized in the mathematics classroom.

Danenberg, Anne. (2001). **"Who's Lagging Now?: Gender Differences in Secondary Course Enrollments."** San Francisco, CA: Public Policy Institute of California. Available at: http://www.ppic.org/publications/CalCounts2/calcounts.page.html

Major results from this report on California secondary school education show that high school boys lag girls in English, foreign language, and social science but that girls are 10% less likely than boys to take physics and 43% less like to take college-prep computer science classes. Girls also fall behind boys in participating in AP courses in calculus, chemistry, physics, and computer science. The gender gap in advances math classes proved to be negligible for Whites and Asians, while African-American females enrolled in these courses at much higher rates than their male peers. Such gaps in course-taking patterns first begin to appear as early as grade eight.

Fennema, Elizabeth and Gilah Leder, Eds. (1990). ***Mathematics and Gender***. New York: Teachers College Press.

This collection of essays pulls together some of the theories surrounding differing participation and achievement levels between boys and girls in mathematics. Attention is paid to biology, attribution, teacher-student interactions, and learning styles. Article titles from the book include: "Spatial Skills, Gender, and Mathematics," "Classrooms, Teachers, and Gender Differences in Mathematics," "Internal Influences on Gender Differences in Mathematics," and "Teachers' Beliefs and Gender Differences in Mathematics."

Ginorio, Angela and Michelle Huston. (2000). ***S, Se Puede! Yes, We Can: Latinas in School.*** Washington, D.C.: American Association of University Women. To order call: 1-800-225-9998.

This report found that Latinas bring many personal strengths and cultural resources to the schools they attend. For them to become successful, the report contends, schools need to view bilingualism and other values as assets rather than liabilities. Latinas are lagging behind other racial and ethnic groups of girls in several key measures of educational achievement and have not benefited from gender equity to the extent that other groups of girls have. Analyzing the differences in educational achievement between Latinas and other groups of girls, the report finds that: the high school graduation rate for Latinas is lower than for girls in any other racial or ethnic group; Latinas are less likely to take the SAT exam than their White or Asian counterparts; compared with their female peers, Latinas are under-enrolled in Gifted and Talented Education (GATE) courses and underrepresented in AP courses.; and Latinas are the least likely of any group of women to complete a bachelor s degree. Report recommendations include: all adults need to encourage academic success; Hispanic teachers must be recruited and trained; the whole family should be involved in the process of college preparation; and dealing meaningfully with stereotypes and societal issues such as teen pregnancy that impact school performance.

Hansen, Sunny, Joyce Walker, and Barbara Flom. (1995). ***Growing Smart: What's Working for Girls in School.*** Washington, D.C.: American Association of University Women Educational Foundation. To order call: 1-800-225-9998 ext. 459.

A synthesis of more than 500 studies and reports, *Growing Smart* pulls together some of the common denominators from programs that have successfully engaged K-12 girls in learning. It lays out five themes that emerged repeatedly from the programs: (1) celebrate girls' strong identities; (2) respect girls as central players; (3) connect girls to caring adults; (4) ensure girls' participation and success; and (5) empower girls to realize their dreams. The authors offer action strategies as well as details about specific programs of interest (including several with a MST focus).

Hanson, Kathleen. (1997). **Gender, Discourse, and Technology.** Newton, MA: Education Development Center, Center for Equity and Cultural Diversity.

Despite the emphasis and importance placed on technology within the United States, technology is not equally accessible to all sections of society. Computers are disproportionately seen in upper and middle class households, with the access and availability of technology absent in poorer populations. Instead of focusing this problem on the student, a cultural context needs to be developed to understand discrepancies in the accessibility of technology. This issue is addressed by defining technology and relating it

to race, gender and class, as well as looking at workplace and classroom cultures. Topics to address, such as computer games and violence, and concrete suggestions are provided for teachers and parents to analyze and implement so that technology can be put in a cultural context and opportunities for change can be realized.

Lee, Valerie, Xianglei Chen, and Becky Smerdon. (1996). ***The Influence of School Climate on Gender Differences in the Achievement and Engagement of Young Adolescents.*** Washington, D.C.: American Association of University Women Educational Foundation.

Defining school climate to include three areas - teaching and learning climate, normative climate, and composition/structure climate - this study looked at the effects of each on girls' achievement in almost 400 schools. Larger gender differences favoring males in science and social studies were found in schools with more positive teacher-student relations. Schools with higher levels of parental involvement revealed a disadvantage for girls in math.

Levi, Linda. (2000). **Gender Equity in Mathematics Education** . *Research into Practice*, October.

Studying the K-12 school experience in mathematics education can help to determine why there are gender inequities in future mathematics participation. Three different roles that teachers play in their attempt to address gender equity in math are highlighted. Teachers seem to either try to provide equal opportunities and respect differences; try to ensure that girls and boys have the same experience; or attempt to compensate for gender differences in society. Each technique is analyzed and critiqued and an activity sheet on gender equity in math is provided for teachers to complete. The intent is to have teachers form small groups and share what they filled out so as to initiate discussion of equity issues.

National Center for Education Statistics. (2000). ***The Condition of Education 2000.*** Washington, D.C.: Author. To order call: 1-877-4ED-PUBS. Available at: http://nces.ed.gov/pubs2000/coe2000/

This compilation of information spans K-16 learning, includes multiple school subject areas, and looks at both in-school and out-of-school learning. Data is disaggregated based on race, gender, language of origin, income, and age. The achievement gap between White students and students of color, disparities in public school finance, and gender differences in attitudes about math are among the many areas considered.

National Center for Educational Statistics. (2000). ***Entry and Persistence of Women and Minorities in College Science and Engineering Education.*** Washington, D.C.: Author. Available at: http://www.nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000601

There are gaps related to gender and race/ethnicity representation in post-secondary science and engineering (S&E) education. A study was conducted to examine these gaps. An analysis of the link between high school experience and entrance into post-secondary education in S&E was performed, as well as an analysis of persistence and degree attainment of a post-secondary degree in S&E as it relates to underrepresented groups and gender. Policy issues are illuminated to help address equity concerns of entry and persistence in S&E programs.

National Center for Education Statistics. (1997). **"Women in Mathematics and Science."** *Findings from the Condition of Education 1997*. Washington, D.C.: Author. Available at: http://nces.ed.gov/pubs97/97982.html

Some of the findings related to mathematics from this study include: no measurable difference in proficiency between boys and girls ages 9 and 13; 17-year-old girls scored lower than their male peers; as early as eighth grade boys were more than twice as likely to aspire to math-related careers as girls; females were more likely than males to say they had been advised against taking advanced math courses in high school; students of both genders report a similar liking of mathematics.

National Coalition for Women and Girls in Education. (1997). ***Title IX at 25: Report Card on Gender Equity***. Washington, D.C.: Author.

This book analyzes how girls fare across all subject areas. Information on mathematics shows girls as proficient as boys through most grade levels, but still lagging behind on SAT-M scores. Girls also report less confidence in math, which may be correlated with their decreased interest in math during post-secondary study. This decreased interest may also be due to a hostile environment.

Northwest Regional Educational Laboratory. (1997). ***Science and Mathematics for All Students: It's Just Good Teaching***. Portland, OR: Author. Available at: http://www.nwrel.org/msec/pub.html

This paper rests on the premise that many of the strategies designed to make classrooms more equitable are simply ones that are good teaching practices for all students. Some of these include holding high expectations for all students, creating a welcoming classroom environment that celebrates diversity, using varied teaching strategies, and making connections between new ideas and students' personal experiences. Areas of gender and racial equity are covered through information related to learning styles, classroom interactions, ability grouping/tracking, cooperative learning, hands-on activities, writing, and single-sex grouping.

Ogbu, John. (1994). **"Overcoming Racial Barriers to Equal Access."** in John Goodland and Pamela Keating (Eds.), *Access to Knowledge: The Continuing Agenda for Our Nation's Schools.* New York: College Entrance Examination Board.

Ogbu distinguishes between two types of racial minorities in the United States: immigrant, or voluntary, minorities (e.g. the Chinese in Stockton, CA and the Punjabi Indians in Valleyside, CA), and caste-like, or involuntary, minorities (e.g. Black Americans who were brought to the U.S. as slaves and American Indians). Immigrants do not tend to see success in school as acculturation or loss of culture in the same way that involuntary minorities do. They tend to accept the White middle class ideal that anyone can get ahead through hard work and good education, whereas involuntary minorities do not see many job opportunities open to them no matter how hard they work. Immigrants also tend to trust White people and public schools more than involuntary minorities do. These are some of the reasons the author cites for the differences in school achievement between members of the two categories. He also claims that the job ceiling many Black Americans face once they enter the workforce as well as the inferior

education they have historically received, among other factors, catalyze Black students into adaptive/coping responses that create further barriers to school success.

Ortiz-Franco, Luis, Norma Hernandez, and Yolanda De La Cruz, Eds. (1999). ***Perspectives on Latinos***. Part of Walter Secada (Series Ed.),"Changing the Faces of Mathematics." Reston, VA: National Council of Teachers of Mathematics. To order call: 1-800-235-7566.

The articles collected in this volume cover the terrain of how Latino students are faring in mathematics in the 1990s, with special emphasis placed on the experiences of Latinos in standards-based classrooms. Divided into five sections, the book covers: socioeconomic issues; language issues; teaching-learning aids; staff development; and intervention programs. The first two sections provide a comprehensive overview of many of the issues Latino students face in the mathematics classroom. Many of the articles also include suggestions for classroom practices, derived from teachers' own experiences as well as research findings. The final section on interventions presents successful program models used throughout the United States.

Reese, Clyde, Karen Miller, John Mazzeo, and John Dossey. (1997). ***NAEP 1996 Mathematics Report Card for the Nation and the States***. Washington, D.C.: National Center for Education Statistics.

The NAEP mathematics assessment utilizes a NCTM standards-based framework with children in grades four, eight, and twelve. Major findings from the 1996 assessment reveal racial, economic, and gender differences in achievement. While no difference was found for girls and boys in grades eight and twelve, differences favoring boys did appear in grade four. Scores for White, Hispanic, and Native American students stood below those of White students. A positive correlation was found between students' scores and parents' education level. Four- and eighth-grade students receiving Title I assistance had lower scale scores than those who didn't qualify for Title I.

Rousso, Harilyn & Michael Webmeyer, Eds. (2001). *Double jeopardy: Addressing gender equity in special education.* Albany, NY: SUNY Press.

Girls and young women with disabilities are faced with discrimination and inequities in the education system. In comparison to disabled male counterparts or non-disabled females, disabled women are less likely to achieve equivalent vocational success upon leaving school. Issues such as biased curricula and inequitable student-teacher interactions are analyzed. Strategies and innovative programs are highlighted to help empower disabled youth.

Sadker, David and Myra. (1994) ***Failing at Fairness: How America's Schools Cheat Girls***. New York: Charles Scribner's Sons.

Using vignettes of classroom scenes, decades of research, and interviews with students, *Failing at Fairness* delves into the challenges and inequities confronting girls in U.S. schools. Covering topics such as self-esteem, student-teacher interactions, curriculum, and higher education, it exposes the ways in which bias, exclusion, and psychological factors play a role in limiting girls' and women's education.

Sadker, Myra and David, and Lynette Long. (1989). **"Gender and Educational Equality."** In James A. Banks and Cherry A. McGee (Eds.), *Multicultural Education: Issue and Perspectives*. Boston: Allyn & Bacon.

This overview of gender equity and education highlights some of the ways girls are disenfranchised from the learning process. It covers information such as curricular bias, calling on boys more than girls, asking boys more higher-level questions, and sex segregation in the classroom. The authors lay out the costs of sexism in school - such as girls being invisible members of classrooms and their reporting mathematics as less important and useful - and offer solutions to some of these dilemmas.

Schifter, Deborah, Ed. (1996). **Teaching Mathematics to All Students,"** in *What s Happening in Math Class?*, Volume 1. New York: Teachers College Press.

Four narratives by teachers are provided to illustrate and address issues of diversity in mathematics, the use of mixed-ability grouping and the concept of teaching mathematics to *all* students. Alissa Sheinbach talks about juggling her mainstreamed learning-disabled third and fourth grade students. Allen Gagnon, a teacher in an urban high school discusses his Spanish-speaking students. Margaret Riddle assesses the opportunities that mixed-ability grouping offers to the math stars among her fifth graders. The final narrative, written by teacher educator Rafaella Borasi, questions accepted definitions of homogeneous and diversity and how student diversity can be turned into an asset for mathematics instruction.

Schulman, Bonnie Jean. (1994). **Implications of Feminist Critiques of Science for the Teaching of Mathematics and Science.** *Journal of Women and Minorities in Science and Engineering*, Vol. 1, pp. 1-15.

Science and the scientific method have always been viewed as objective and rational. However, the author highlights a series of feminist critiques of science as gendered and biased and ultimately rooted within the framework of white male thought. If science is an ideology (that it s possible to know the world as a rational and orderly mechanism) then it is affected by language, culture and differing views of the natural world. Math as the language of science uses assumptions (givens) that are specific to culture and belief systems to solve problems and make logical deductions. The author intends to inform and initiate dialogue to address the way that math and science are taught and how education can be reformed to incorporate these feminist critiques. Themes discussed: science as ideology, math as the language of scientific thought, math as a gendered discourse, culture is classification and values of mathematics

Secada, Walter, Ed. (2000). *Perspectives on Multiculturalism and Gender Equity*. Part of Walter Secada (Series Ed.), "Changing the Faces of Mathematics." Reston, VA: National Council of Teachers of Mathematics. To order call: 1-800-235-7566.

This volume provides an up-to-date look at the link between standards-based math reform and gender equity/multiculturalism. The lead article by Julian Weissglass sets the stage by arguing for a need to envision an infrastructure for dealing with equity in mathematics education. Articles that follow examine the use/misuse of multiculturalism in the classroom, a look at technology and equity, heterogeneous classes, a discussion of how to

authentically embrace diversity and difference, and an exercise in using Barbie as a mathematical tool for talking about body image.

Secada, Walter G., Elizabeth Fennema, and Lisa Byrd Adajian, Eds. (1994). ***New Directions for Equity in Mathematics Education***. New York: Cambridge University Press.

With a collection of fourteen articles, this volume tackles educational equity as it relates to gender, race, class, and linguistic minorities. Chapter titles include: "Social and critical dimensions for equity in mathematics"; "Redefining the 'girl problem in mathematics'"; "Gender and mathematics from a feminist standpoint"; and "Equity and mathematics education."

Silver, Edward and Patricia Ann Kenney, Eds. (2000). ***Results from the Seventh Mathematics Assessment of the National Assessment of Educational Progress.*** Reston, VA: National Council of Teachers of Mathematics.

Chapters 3 and 4 tackle the National Assessment of Educational Progress (NAEP) findings as they pertain to race/ethnicity and gender. Black and Hispanic students narrowed the performance gap with White students from 1973-1996, yet large differences still exist, particularly with extended response or complex problem solving items. Students of all ethnicities reported similar course taking patterns, though Black and Hispanic students are underrepresented in higher-end mathematics courses. The amount of instruction time spent on mathematics was higher for all groups in grade 4 than in grade 8. Hispanic and White students in grade 8 were more likely than their Black peers to have teachers who emphasized reasoning and non-routine problem solving. In grade 4 Black and Hispanic students were more likely to be given multiple-choice tests than Whites. The only significant gender differences were found on the grade 4 mathematics exam, in favor of males. These differences appeared mostly within 3 strands - Measurement; Geometry and Spatial Sense; and Number Sense, Properties and Operations. Both males and females report a positive self-concept in mathematics in grade 4, but this declines in later years, with girls' self-concept dropping faster than boys'. Students' intention to continue studying mathematics follows a similar pattern.

Simon, Mary K. (2000). **The Evolving Role of Women in Mathematics.** *Mathematics Teacher*, Vol. 93 (No. 9), 782-786.

An overview and investigation of women s traditionally limited involvement in mathematics is provided. Starting from the exclusion of women based on gender biases in 600 BCE to the present day gender gap in math and science, the author argues that there is still a need for accessibility, development and encouragement of women to enter the field. Notable female mathematicians are highlighted to show women to be capable of achieving and contributing to the field despite gender biases. Mathematics can enable women to partake in and effect current technologies and social change.

Strutchens, Marilyn, Martin Johnson, and William Tate, Eds. (2000). ***Perspectives on African Americans***. Part of Walter Secada (Series Ed.),"Changing the Faces of Mathematics." Reston, VA: National Council of Teachers of Mathematics. To order call: 1-800-235-7566.

The articles collected in this volume cover the terrain of how African American students are faring in mathematics in the 1990s, with special emphasis placed on the experiences

of African Americans in standards-based classrooms. Divided into four sections, the book covers: research related to teaching and learning; instructional and curricular modifications; specific methodologies; and future mathematicians and mathematics educators. The initial articles set the stage by tackling stereotypes/beliefs and teacher expectations. Subsequent articles outline methods such as collaborative groups, "call and response" pedagogy, media connections, and using culturally relevant material. The final articles look at African Americans in higher education and the career world.

Sullivan, E. (1994). **"Achieving Equity in Mathematics Education."** *Thrust for Educational Leadership*, Vol. 23, 12-15.

The effects of sex-role stereotyping are discussed at length in this article. Through communicating more with males, asking males more complex questions, and praising males for the intellectual quality of their work, mathematics teachers send subtle messages to girls that translate into a decreased interest in math later on. The author concludes with steps that teachers and administrators can take to deal girls back in to the math classroom.

Tate, William. (1997). **"Race-Ethnicity, SES, Gender, and Language Proficiency Trends in Mathematics Achievement: an Update."** *Journal for Research in Mathematics Education*, Vol. 28 (No. 6), 652-679.

This review of national trend studies, college admissions exams, and Advanced Placement tests details the current state of mathematics achievement in the U.S. for traditionally underrepresented groups. While achievement levels favored boys over girls slightly, the largest disparities were found between White students and students of color, between upper-/middle-class students and working-class/poor students, and between native English speakers and ESL students. Furthermore, while all groups improved basic skill levels over the last fifteen years, the large gaps among groups on complex mathematical thinking tasks result in continued inequality.

Tate, William. (August 1995). **School Mathematics and African American Students: Thinking Seriously About Opportunity-to-Learn Standards.** *Educational Administration Quarterly*, Vol. 31, No. 3.

Critical race theory is used to analyze how political and conceptual frameworks affect opportunity-to-learn standards. Specifically addressed is how opportunity-to-learn standards affect equity issues in regard to mathematics standards for African American students. The history and theory of math reform and opportunity-to-learn standards are provided to enter a discussion about equity in math education. Topics analyzed are the purposes of math education, how math knowledge is acquired, fiscal conditions of schools, and cultural factors in math education to better understand how African Americans can best succeed in math. It is suggested that opportunity-to-learn standards should be based on; the rapid growth and change in mathematics; constructivist principles of learning; the concept of fiscal adequacy; and cultural factors that influence mathematics.

WEEA Digest. (2000). ***Gender Equity for Males***. Newton, MA: Author. To order call: 1-800-793-5076. Available at: http://www.edc.org/WomensEquity/pdffiles/males.pdf.pdf

This issue of the Women s Education Equity Act Digest addresses gender equity in education for males. The focus is on definitions and concepts of masculinity in respect to traditional gender roles, academic achievement, and violence in schools as well as the break down of stereotypes of African American male behavior.

WEEA Digest. (2000). ***Connecting Gender and Disability***. Newton, MA: Author. To order call: 1-800-793-5076

This digest summarizes the status of girls and women with disabilities, the challenges an discrimination they face - as females and as persons with disabilities - and how school systems can improve education. This comprehensive perspective unites both the gender equity and disability communities.

Wrigley, Julia, Ed. (1992). ***Education and Gender Equality***. Washington, D.C.: The Falmer Press.

Looking at education from an international perspective, this book tackles four topic areas: the role of the state and public policy in shaping education, gender and social relations in the classroom, the social context of learning, and the link between families and schools. Many of the articles look at the intersection of gender, race, and/or class in classrooms around the world. Article titles include: "Gender and Education in the Welfare State," "Race and the Schooling of Young Girls," "Opportunity and Performance: a Sociological Explanation for Gender Differences in Mathematics," and "Gender Differences in Parental Involvement in Schooling."

Parents

Campbell, Patricia. (1992). ***Math, Science, and Your Daughter: What Parents Can Do.*** Washington, D.C.: U.S. Dept. of Education. To order call: 1-800-225-3088.

This pamphlet helps parents encourage their daughters in math and science by offering practical tips and suggestions. Some of the suggestions that the author offers include helping to reduce stereotypes, making math and science fun, demonstrating the relevance of math and science in everyday life, and encouraging daughters.

Carr, Martha, Donna Jessup, and Diana Fuller. (1999). **"Gender Differences in First-Grade Strategy Use: Parent and Teacher Contributions."** *Journal for Research in Mathematics Education*, Vol. 30 (No. 1), 20-46.

This study indicated that boys in the first grade benefited from teachers' strategy instruction, whereas girls did not benefit and were in fact hurt by it. Girls were not influenced by parental instruction in overt strategy use (e.g. counting on fingers and counters), but did improve their use of covert strategies (e.g. invented algorithms) when instructed by a parent to utilize such strategies.

Eccles, Jacquelynne, Janis Jacobs, and Rena Harold. (1990). **"Gender Roles Stereotypes, Expectancy Effects, and Parents' Socialization of Gender Differences."** *Journal of Social Issues*, Vol. 46, 183-201.

In studying parents' gender stereotypes and attitudes, researchers found that mothers attributed the success of boys in mathematics to natural talent whereas they viewed girls' success as related to effort. In a separate study to determine if mothers thought boys or girls were more naturally talented in mathematics, the researchers discovered no differences in the mothers' perceptions of their children's abilities. However, the mothers did believe that males were more naturally talented in mathematics than females.

Kohn, Alfie. (1998). **"Only for *My* Kid: How Privileged Parents Undermine School Reform."** *Phi Beta Kappan*, Vol. 79 (No. 8), 569-577.

Kohn explores the attitudes regarding school reform among financially privileged parents. He posits that these parents' desire for their children to be the best motivates them to resist school reform and its goal of improving education for all children through detracking, cooperative learning, the elimination of grades and other measures.

Lareau, Anette. (1992). **"Gender Differences in Parent Involvement in Schooling."** in Julia Wrigley (Ed.), *Education and Gender Equality*. Washington, D.C.: The Falmer Press.

In this study, mothers in both working- and upper-middle-class families were more involved in their children's education than fathers. Mothers more than fathers deferred to the authority of the teacher; this was especially true for working-class parents. Upper-middle-class parents attended more in-school activities such as Open House and parent-teacher conference than did families with fewer economic resources. Owing to doubts about their own educational knowledge, working-class parents tended to not help their children with homework as much and to turn over responsibility to the school more than

upper-middle-class parents. No differences were found between the two groups with regards to the value or their children of education.

The National Coalition of Girls' Schools. ***Raising Confident, Competent Daughters: Strategies for Parents***. Concord, MA: Author. To order call: 978-287-4485.

A collection of powerful and practical suggestions for parents on how to raise happy, successful daughters. Written by five girls' school heads.

Tocci, Cynthia M. and George Engelhard, Jr. (1991). **"Achievement, Parental Support, and Gender Differences in Attitudes Toward Mathematics."** *Journal of Educational Research*, Vol. 84 (No. 5), 280-286.

This study of 13 year-olds in the United States and Thailand demonstrated a correlation between parental support and students' attitudes towards mathematics. As levels of perceived parental support increased for students, their attitudes that math was useful, that it was not simply a male domain, and that they were capable mathematical learners all increased, while students' anxiety levels decreased. There was no significant interaction effect between gender and parental support for students in the U.S. (though one was found for students in Thailand).

Updegraff , Kimberly, Susan McHale, and Ann Crouter. (1996). **"Gender Roles in Marriage: What Do They Mean for Girls' and Boys' School Achievement?"** *Journal of Youth and Adolescence*, Vol. 25 (No. 1), 73-88.

Findings from this study show that girls from egalitarian families (defined as families where the father was more involved in childcare than in more traditional homes) maintained a high level of academic achievement during the transition to seventh grade, whereas girls from families with more traditional gender roles declined in math and science performance over this period.

Pedagogy

Auger, Jessie. (2001). **"Who Do We Hear?"** *Rethinking Schools*, Fall 2001.Available at: http://www.rethinkingschools.org/Archives/16_01/Who161.htm

This elementary school teacher reflects on the ways teachers must be attuned to students' different ways of expressing mathematics knowledge. The three scenarios presented illustrate how crucial it is for educators, particularly White teachers working in racially diverse settings, to recognize the differences between their discourse patterns and those of their students. Teachers must expand the idea of what constitutes mathematical language, while also helping traditionally underserved students (namely girls, low-income students, and students of color) master the academic language of the dominant culture.

Artzt, Alice, and Claire Newman. (1998). ***How to Use Cooperative Learning in the Mathematics Classroom***. Reston, VA: National Council of Teachers of Mathematics.

Starting off with some reasons why cooperative learning can benefit students with diverse learning needs, this book talks about some effective strategies for creating groups: to ensure heterogeneity teachers should set up groups; structuring group tasks so that each students must contribute to the work at hand helps students recognize their dependence on one another; peer teaching can be an effective learning tool; and assessment should look at whole-group work as well as individual's performance. The remainder of the book describes a range of cooperative group activities teachers can use in the mathematics classroom.

Banks, Cherry McGee and James Banks. (1995). **"Equity Pedagogy: An Essential Component of Multicultural Education."** *Theory into Practice*, Vol. 34 (No. 3), 152-158.

The authors describe equity pedagogy as a component of multicultural education that helps students develop the knowledge and skills necessary for functioning within and creating a just and democratic society. While strategies such as cooperative groups and culturally relevant instruction are part of good teaching, they alone do not constitute equity pedagogy. The power relationship between student and teacher must shift: students generate knowledge, construct their own interpretations of reality, and find multiple solutions. Teachers must pay attention to the complex backgrounds of each individual student and diversify their instruction accordingly.

Boaler, Jo. (1997). ***Experiencing School Mathematics: Teaching Styles, Sex, and Setting***. Buckingham, England: Open University Press.

The author studied two high schools in England for three years as a way of assessing the effectiveness of their differing mathematical pedagogies. A chapter in the book on gender and learning styles discusses the benefits to girls of inquiry-based, student-driven, cooperative learning.

Bohn, Anita and Christine Sleeter. (2000). **"Multicultural Education and the Standards Movement."** *Phi Delta Kappan*, Vol. 82 (No. 2), 156-159.

The push towards standards - and the subsequent standardization of the curriculum - stifles students' exploration and recognition of cultural diversity within a classroom. When diverse cultures are discussed it is usually as an add-on rather than integral to the curriculum. The end result is a disconnect between students' lives and textbook knowledge. The authors advocate for teachers examining their own multicultural knowledge base, racial identity, and the intellectual contributions of people from varied ethnicities. At the center of multicultural reform lies a dialogue across groups and a commitment to sharing power.

Campbell, Patricia and Jennifer Storo. (1994). ***Why Me? Why My Classroom?: The Need for Equity in Coed Math and Science Classes.*** Washington, D.C.: U.S. Department of Education. Available at: http://www.campbell-kibler.com/

Contains statistics related to girls and math education, differences in the ways that teachers interact with girls and boys, and a reflection exercise designed to assess if a classroom is equitable.

Cohen, Elizabeth. (1972). ***Designing Groupwork: Strategies for the Heterogeneous Classroom***. New York: Teachers College Press.

For teachers both new to and experienced with group work, this book lays out the basics of designing cooperative groups while also asking educators to consider the potential equity issues involved in using such groups in the classroom. Chapters cover the rationale behind using cooperative groups, the teacher's role, expectations (both from the teacher and from students themselves), tools for evaluating group effectiveness and equity, groups in bilingual and multi-ability classrooms, and suggested activities.

Cohen, Elizabeth. (1998). **"Making Cooperative Learning Equitable."** *Educational Leadership*, Sept.

Cooperative learning activities can become inequitable if teachers do not attend to the status differences between students. Low-status members talk less than others, often their ideas are not taken seriously, and they have difficulty getting their hands on manipulatives. All of these behaviors lead to fewer and less-effective learning opportunities for such students. Status comes from academic performance, popularity among peers, attractiveness, gender, race, and class. To treat such status inequalities, teachers must convince students that: (1) Cooperative tasks require many types of abilities. (2) No one will have all of these abilities. (3) Everyone will have some of these abilities. Teachers can also assign competence to a student by giving a positive evaluation publicly that is truthful and on skills that are relevant to the group task.

Cohen, Elizabeth, and Rachel Lotan. (1995). **"Producing Equity-Status Interaction in the Heterogeneous Classroom."** *American Educational Research Journal*, Vol. 32 (No. 1), 99-120.

In heterogeneous classrooms students with high academic status are often treated differently from those with low status during cooperative group activities, with those perceived as having higher status dominating. The authors suggest teachers use multiple ability treatment - assigning competence to low-status students - as one tool to equalize status. This strategy involves teachers giving low-status students feedback that is public, specific, and valid that details a student's particular strengths as they relate to the task at

hand. The study highlighted in this article supports the value of multiple ability treatments, with classroom and group interactions equalized between high- and low-status students after teacher intervention.

Cohen, Elizabeth, Rachel Lotan, Beth Scarloss, and Adele Arellano. (1999). **"Complex Instruction: Equity in Cooperative Learning Classrooms."** *Theory into Practice*, Vol. 38 (No. 2), 80-86.

While cooperative learning groups can promote equity in the classroom, they poses the potential problem of excluding students who are low-achieving or who are social isolates. In Complex Instruction (CI) classrooms students are assigned open-ended, interdependent group tasks and serve as academic and linguistic resources for each other. Achievement results show more gain for students in CI classes than students in comparison classes on higher-order thinking tasks. Teachers assign competence to students publicly as a way to boost the standing of low-status students. Educators also publicly recognize the varied skills of students through a process called multiple-abilities treatment.

Devenport, Linda Ruiz. (1993). **The Effects of Homogenous Groupings in Mathematics**. ERIC/CSMEE Digest. Available at: http://www.ed.gov/databases/ERIC_Digests/ed359065.html

Homogenous grouping, especially for higher level mathematics instruction is more prevalent in the United States than in any other country. There is growing concern about this practice and the belief that intellectual differences amongst students are so great that they need to be taught in separate groups and/or classes depending on different ability or achievement levels. When analyzing differences in math education not only between schools but also within schools, a study conducted by the National Science Foundation identified 3 areas of inequities in math instruction: access to strong math programs; access to well-qualified math teachers and; access to classroom opportunities. Tracking, particularly in secondary schools has shown to limit learning and ends up widening the achievement gaps between students. Citing different studies and providing examples, homogenous grouping is shown to have little effect on achievement. The long-term effects of tracking on female and minority students can be seen by their underrepresentation in the mathematics and sciences area.

Delpit, Lisa. (1988). **"The Silenced Dialogue: Power and Pedagogy in Educating Other People's Children."** *Harvard Educational Review*, Vol. 58 (No. 3), 280-298.

Attacking the "skills" versus "process" debate, the author points out that the real issue in educating poor students and people of color rests in communicating across cultures and not in instructional methodology. Well-intentioned teachers who deflect power from themselves by using process-oriented approaches (e.g. whole language instruction, de-emphasis on the product of a student's work, etc.) in fact do a disservice to their students by not being explicit about the set of rules governing society at large. Instead educators should: instruct students on the codes needed to participate fully in mainstream society; use their own expert knowledge while also validating students' "expertness;" and talk with students about the arbitrariness of the codes and the power relationships they represent.

Fennema, Elizabeth and Penelope Peterson. (1986). **"Teacher-Student Interactions and Sex-Related Differences in Learning Mathematics."** *Teacher and Teacher Education*, Vol. 2 (No. 1), 19-42.

This study analyzed the effects of teacher-student interactions on high- and low-level mathematics achievement for girls and boys. Findings indicated that many interaction patterns that significantly affected girls' mathematical achievement had no impact on boys' achievement or were related significantly in the opposite direction. Teachers initiated interactions with boys more than with girls, gave strategies to solve a problem after an incorrect answer more often to boys than to their female peers, and offered less feedback to higher achieving girls after a correct response than to similarly achieving boys.

Fennema, Elizabeth, Penelope Peterson, Thomas Carpenter, and Cheryl Lubinski. (1990). **"Teachers' Attributions and Beliefs About Girls, Boys, and Mathematics."** *Educational Studies in Mathematics*, Vol. 21 (No. 1), 55-69.

Teachers tend to attribute boys' mathematical successes and failures to ability and girls' successes and failures to effort. They described their best male students as more adventurous, volunteering more answers, enjoying math more, and more independent than their best female students.

Fennema, Elizabeth, Thomas P. Carpenter, Victoria R. Jacobs, Megan L. Franke, Susan B. Empson, and Linda W. Levi. (1996). **"A Longitudinal Study of Learning to Use Children's Thinking in Mathematics Instruction."** *Journal for Research in Mathematics Education*, Vol. 27 (No. 4) 403-434.

In this study teachers' use of Cognitively Guided Instruction (CGI) resulted in an improvement in students' math achievement and problem-solving abilities in particular. CGI encourages teachers to reflect on each child's mathematical thinking, to provide opportunities for varied problem-solving strategies, and to allow students' thinking to drive instruction.

Greene, Elizabeth. (2000). **Good-Bye Pythagorous?** *The Chronicle for Higher Education*, October 6. Available at: http://www.rpi.edu/web/News/pythagoras.html

As we move towards globalization, it s become increasingly important to recognize and respect non-European methods of thought. Ethnomathematics, the teaching of math from a cultural perspective, attempts to contextualize and diversify math instruction. Although no empirical research has been conducted, ethnomathematics is thought to be more engaging and accessible to students. However, critics worry that incorporating diversity into all aspects of mathematics teaching takes away from the rigor of fundamental concepts of European-based mathematics that is needed to pursue higher levels of math as well as to enter fields that require a deeper understanding of math.

Haberman, Martin. (1991). **"The Pedagogy of Poverty Versus Good Teaching."** *Phi Delta Kappan*, Vol. 73 (No. 4), 290-294.

The author compares the teaching methods typically practiced in urban classrooms - what he calls a "pedagogy of poverty" - to those advocated for by math reformers. While reform math proponents argue for the teaching of critical thinking, problem solving, and

creativity, urban teaching in contrast consists of directive teacher acts, less complex tasks, and lower expectations for students. The article concludes with twelve behaviors (evidenced by what students are doing) signifying good teaching. Included in this list are: students being involved with issues they see as relevant to their lives; students learning major concepts and big ideas as opposed to isolated facts; students helping to plan what they will do; students working in heterogeneous groups; and students re-doing or perfecting their work.

Hanson, Katherine. (1992). **"Teaching Mathematics Effectively and Equitably to Females."** New York: ERIC Clearinghouse on Urban Education. To order call: 1-800-225-3088.

Hanson's report looks to both student-centered explanations (e.g. learning styles and attitudes towards mathematics) and pedagogy (e.g. teacher attitudes and curriculum content) as a way to explain gender differences in math achievement. Some of her findings include: young girls gain less experience than boys with core math concepts due to the kinds of toys geared toward each sex; strong social messages that math is for boys lead to girls self-selecting out of math-related activities as early as preschool; math curricula in middle and high school emphasizes skills (such as abstract concepts and spatial visualization) that girls often have less experience with in pre-school and at the primary level; girls receive more attention from teachers on product questions while boys receive more time on process (or higher order) questions. The report concludes with fifteen recommendations to help create an equitable climate in mathematics.

Howard, Gary R. (1999). ***We Can t Teach What We Don t Know: White Teachers, Multiracial Schools***. New York: Teachers College Press.

Through personal experience, discovery and reflection, the author writes about the implications of being a white teacher in racially diverse schools. Topics covered are social and white dominance, the dynamics of dominance, racial identity development and a transformative approach to change. The book incorporates theoretical frameworks and practical situations, which illustrate ways in which to achieve awareness and sensitivity to diverse students.

Jungwirth (1991). **"Interaction and Gender: Findings of a Microethnographical Approach to Classroom Discourse"**, *Educational Studies in Mathematics*, Vol. 22, 263-284.

The author of this study argues that what appears to be mathematical incompetence on the part of girls stems from the nature of their interactions with the teachers. Girls tend to avoid participating in class discussions when they are unclear on how to solve a problem, offer a "too complete description" for answers, have few opportunities to rework incorrect answers, and will say nothing instead of turning to the teacher's method of problem-solving (which then creates an appearance of failure).

Linchevski, Liora and Bilha Kutscher. (1998). **"Tell Me With Whom You're Learning, and I'll Tell You How Much You've Learned: Mixed-Ability Grouping Versus Same-Ability Grouping in Mathematics."** *Journal for Research in Mathematics Education*, Vol. 29 (No. 5), 533-554.

This study compared students in mixed-ability classrooms with those in same-ability settings to determine the effects of tracking on students of all ability levels. Results of the study revealed that (1) homogeneous groupings exacerbated achievement level differences between high- and low-ability students, whereas differences in heterogeneous groupings remained constant from the initial assessment, (2) the average scores for low-ability students in homogeneous groupings were significantly lower than those in mixed groups at the end of the study; the scores of high-level students in same-ability groups were not significantly higher than those in heterogeneous groups, and (3) while most teachers supported heterogeneous grouping, those who had more experience in mixed-ability classrooms held a more positive attitude toward it.

McCollum, Pam. (2001). **"The Missing Piece of the Puzzle: Opportunities to Learn."** *IDRA Newsletter*, Vol. 28 (No. 2), February. Available at: http://www.idra.org/Newslttr/2001/Feb/Pam.htm#Art2

Concern about the ways immigrant students get lost in the drive for standards and accountability, the author proposes a series of opportunity-to-learn standards for recent English as a Second Language learners. ESL programs must enable students to use English for academic content. Amendments must be made to existing policies to accommodate the needs of ESL students. All teachers must be skilled in ESL instruction. Teachers must understand their students' cultural backgrounds. Teachers must understand the basics of educational linguistics. School staff must be able to explain standards in a student's native language. School staff must be able to communicate standards to families. Teachers must be granted sufficient planning time. Relationships between schools, organizations, and business that give students opportunities to grow must be solidified.

Metropolitan Life Company. (1997). **"The Metropolitan Life Survey of the American Teacher."** New York: Author.

Findings from this study show that girls are as likely as boys to aim high, to be competitive in school, and to be as confident as boys that they will achieve their future goals. Girls also report a positive relationship with their teachers, indicating that they believe they are treated as fairly as boys are, and receive as much encouragement and feedback as boys do from their teachers.

Miller, Kristelle, Jane Maddy, Lori Schoch, Helen Rallis, and Billy Jo Hennager. (1997). **"Gender Equity in the Elementary Classroom: The Effects of Intervention with Teaching Methods."** *Gender and Race on the Campus and in the School*, Washington, D.C.: American Association of University Women.

The five fourth-grade teachers in this study participated in an equity intervention program called Gender/Ethnic Expectations and Student Achievement (GESA). They learned about four teaching behaviors that tend to be biased in favor of boys: response opportunities, wait time, probing, and level of questioning. Outcomes from the intervention showed that (1) practices favoring boys over girls decreased; (2) in one classroom students' self-concept significantly increased while in two classrooms it significantly decreased; and (3) teachers' use of follow-up probing questions had a significant negative impact on girls' self-concept.

Nieto, Sonia. (1999). ***The Light in Their Eyes: Creating Multicultural Learning Communities***. New York: Teachers College Press.

Rather than conceiving of multicultural education as a series of activities and lessons that can be added on to the "regular" curriculum, the editor of this volume suggests that a transformation within schools, classrooms, and individuals is needed to truly connect with students from diverse backgrounds. The seven broad categories covered in this book include: the social context of learning; learning and inequality; culture and learning; institutional transformation to promote learning; critical pedagogy; the personal and collective transformation of teachers; and creating learning communities.

Reyes, L.H. and G. Stanic. (1988). **"Gender and Race Equity in Primary and Middle School Mathematics Classrooms."** *Arithmetic Teacher*, Vol. 35, 46-48.

This article asks teachers to reflect on the achievement patterns of the students in their classrooms as a window into equity. It offers suggestions on how to create a more equitable mathematics classroom, such as examining personal attitudes, pushing all students to be persistent in problem-solving, and videotaping the classroom.

Strutchens, Marilyn. (1995). **Multicultural Mathematics: A More Inclusive Mathematics .** ERIC. Available at: http://www.ed.gov/databases/ERIC_Digests/ed380295.html

The absence of students culture in mathematics teaching is thought to be a significant barrier to the achievement of students traditionally underrepresented in mathematics. In order to engage and empower these students five dimensions of multicultural education have been identified; content integration; knowledge construction; prejudice reduction; equitable pedagogy; and empowering school culture and social structure. These dimensions are further illuminated indicating implications for teaching mathematics.

Tate, W.F. (1995). **"Returning to the Root: A Culturally Relevant Approach to Mathematics Pedagogy."** *Theory Into Practice*, Vol. 34 (No. 3), 166-173.

The author asserts that traditional mathematics teaching does not draw from the cultural experiences of African American students. He encourages teachers to develop a culturally relevant pedagogical approach that focuses on mathematics problems based on students' own experiences and that asks students to reflect on the social implications of the answers to those problems.

Thousand, Jacqueline, Richard Villa, and Ann Nevin, Eds. (1994). ***Creativity and Cooperative Learning: A Practical Guide to Empowering Students and Teachers***. Baltimore, MD: Paul H. Brookes Publishing Co.

The first eight chapters present an overview of various topics related to cooperative group learning in the primary grades through higher education, such as inclusive classrooms, cooperative education teams, and student disruptions. A list of lesson ideas follows that spans various subject areas and grade levels. Chapters on peer tutoring and peer mediation, building connections among students, and creating new behaviors in the classroom round out the last two sections of the book.

Tomlinson, Carol Ann. (1995). **Differentiating Instruction for Advanced Learners in the Mixed-Ability Middle School Classroom.** *ERIC Digest E536.*

Given that a typical (middle school) classroom has students with different interests, learning preferences, degrees of readiness and learning levels, there is a need for differentiated instruction. With a focus on the needs of academically advanced students in middle schools, this digest illustrates what a differentiated classroom should look like. This includes concentrating on concept and principle, while providing flexible grouping, on-going assessment of student readiness as well as treating students as active explorers , thereby concentrating on the student s learning process rather than their ability to collect and regurgitate information. A comprehensive approach and specific strategies to achieve a differentiated classroom are provided to help teachers figure out what will work best for their classroom.

Trentacosta, J. (Ed.). (1997). ***Multicultural and Gender Equity in the Mathematics Classroom.*** Reston, VA: National Council of Teachers of Mathematics.

This collection of articles covers a range of topics related to teaching reform mathematics. Several of the essays speak to individual teachers' experiences in creating a more equitable classroom. Chapters to note are: "Uncovering Bias in the Classroom-a Personal Journey;" "Know Thyself: The Evolution of an Intervention Gender-Equity Program; " and "The Complexity of Teaching for Gender Equity."

Volpe, Betty. (1999). **"A Girls' Math Olympiad Team."** *Mathematics Teaching in the Middle School*, Vol. 4 (No. 5), 290-293.

Sixth-grade math teacher Betty Volpe recounts the experiences of the students who participated in an all-girls after school Math Olympiad club. Girls in the club reported more confidence in their ability as mathematicians, and took more risks in solving math problems in the context of the single-sex club.

Willis, Scott & Larry Mann. (2000). **Differentiating Instruction: Finding Manageable Ways to Meet Individual Needs.** *Association for Supervision and Curriculum Development Curriculum Update.* Available at: http://www.ascd.org/framecupdate.html

Educators acknowledge the value of modifying instruction to cater to the diverse needs of students. The method to effectively differential instruction entails looking at the content of subject material, the process by which it s learned and the product of how this is demonstrated by the student. Content should be broad and remain constant for all students, while level of complexity may differ depending on level. Process and product should also vary according to level and preference of learning style. Although flexible grouping and tiered activities are imperative, there is no one right way to approach differentiating instruction. In addition to these techniques, a recommendation of different strategies is delineated for teachers to use.

Zucker, Andrew (1995). **Emphasizing Conceptual Understanding and Breadth of Study in Mathematics** , in Knapp, Michael S. (Ed.) *Teaching for Meaning in High-Poverty Classrooms.* New York: Teacher s College Press.

Elementary mathematics reform aims for the achievement of rapid and accurate arithmetic computation while reducing the amount of time and effort spent on this, so that

more time could be spent on higher-order thinking skills. With a math reform agenda that entails a wider range of content than in the past, the actuality is that very little has changed in math education in the past Century. Conventional practices should be replaced with reform strategies that maximize meaning in mathematics instruction by focusing on conceptual understanding of math and by expanding the range of mathematics content. 4 patterns of math instruction are identified to address this goal; emphasizing breadth of study and conceptual understanding, emphasizing breadth of study and discrete learning skills, emphasizing arithmetic and conceptual understand, and emphasizing arithmetic and discrete learning skills.

Psychology

Campbell, Kathleen and Cay Evans. **"Gender Issues in the Classroom: A Comparison of Mathematics Anxiety."** *Education*, Vol. 117 (No. 3), 332-338, 360.

Researchers in this study of ninth-grade students discovered that girls enrolled in a single-sex algebra class reported lower levels of mathematics anxiety than those enrolled in a coed class. In the coed classroom, girls' anxiety levels were not only higher than their female cohorts in single-sex classes, but were also higher than the boys in their class. Furthermore, their anxiety level increased over time, while anxiety decreased for both boys in coed classes and girls in single-sex classes.

Ethington, Corrinna A. (1992). **"Gender Differences in a Psychological Model of Mathematics Achievement."** *Journal for Research in Mathematics Education*, Vol. 23 (No. 2), 166-181.

Using data from the Second International Mathematics Study (SIMS), researchers found that females who are less likely to receive parental help, who are less likely to stereotype math as a male domain, and who view mathematics as less difficult demonstrated higher levels of achievement. Self-concept as it relates to prior mathematics achievement and perceptions of parents' attitudes towards math significantly influence expectations for success for both females and males. Task value (for males and females) and expectations for success (for males only) proved to have the largest effect on the students' decision to continue in mathematics. Girls' achievement was most strongly determined by prior achievement in mathematics.

Fennema, Elizabeth. (1990). **"Teachers' Beliefs and Gender Differences in Mathematics."** in Elizabeth Fennema and Gilah Leder (Eds.), *Mathematics and Gender*. New York: Teachers College Press.

Differences in teachers' expectations for girls and boys may be one factor contributing to gender differences in mathematics. Teachers tend to encourage males to work harder at more complex mathematical problems, while girls are expected to do well with routine problems. Teachers tend to attribute boys' failures to effort and they receive more feedback from teachers on the intellectual quality of their work than females; they tend to attribute girls' failures to lack of ability, and their successes to effort. Teachers tend to give more attention to girls in reading and more attention to boys in mathematics.

Fennema, Elizabeth and Penelope Peterson. (1985). **"Autonomous Learning Behavior: A Possible Explanation of Gender-Related Differences in Mathematics."** In Jane Gaskell and John Willinsky (Eds.), *Gender Influences in Classroom Interaction: From Interaction t to Transformation*. New York: Teachers College Press.

Autonomous Learning Behavior (ALB) includes working independently on high-level tasks, being persistent on these tasks, choosing to do them, and realizing success on them. The authors postulate that some of the gender differences found in mathematics can be traced to boys exhibiting more ALB's than girls. This plays out in girls having less confidence and sense of independence in mathematics, attributing success to external

factors, and viewing math as a male domain. Teachers also facilitate boys' ALB's by asking them more higher-level questions, praising the intellectual quality of their work, and interacting with them more.

Latimer, Kathleen. (2000). **Ethnicity as a Factor in Teachers Perceptions of the Mathematical Competence of Elementary School Students.** *College of Education Review*, Volume 11, Spring.

Elementary teachers with ethnically diverse students in their classrooms were asked to define a mathematically competent student as well as to describe the behaviors and characteristics of their most and least competent students, to assess the extent to which teachers use ethnicity to determine mathematical competence. Teachers identified a positive attitude and eagerness to leant math to those students most competent in mathematics. Ethnicity did not appear to be a primary factor in assigning competence. However, during teacher evaluations, European Americans were chosen more often in both the most and least competent student categories and teachers comments on culture and ethnicity were ambiguous.

Leal-Idrogo, Anita. (1997). **"The Effect of Gender on Interaction, Friendship, and Leadership in Elementary School Classrooms."** In E. Cohen and R. Lotan (Eds.), *Working for Equity in Heterogeneous Classrooms*. New York: Teachers College Press.

The author of this study suggests that how teachers design classroom task structures strongly influences verbal interaction patterns between the sexes. In the complex instruction (CI) classrooms studied, leadership did not prove to be a male characteristic (as previous studies have shown), with a fair number of students perceiving girls as leaders. Furthermore, gender did not operate as a status characteristic in these groups; girls spoke as much as boys did, and the rates of cross-sex talk were the same. Several characteristics of the classroom structure which may contribute to these shifts include: mixed-sex small groups at learning centers; training in cooperative group behaviors; rotating roles within groups; multiple-ability status treatment (each child had a chance to make a contribution).

McIntosh, Peggy. (1998). **"White Privilege: Unpacking the Invisible Knapsack."** in Enid Lee, Deborah Menkart, and Margo Okazawa-Rey (Eds.), *Beyond Heroes and Holidays*. Washington, D.C.: Network of Educators on the Americas.

In trying to uncover the ways in which White privilege has impacted her life, this educator lists 26 advantages she has because of the color of her skin. She distinguishes between positive advantages versus privileges that confer dominance because of one's race. The author realizes that ideas she originally thought were part of being a human being were actually an unearned advantage or conferred dominance given to her because of her Whiteness. In closing she argues for a change in the systems of social dominance that create privilege.

Meyer, Margaret, and Mary Schatz Koehler. (1990). **"Internal Influences on Gender Differences in Mathematics."** in Elizabeth Fennema and Gilah Leder (Eds.), *Mathematics and Gender*. New York: Teachers College Press.

The researchers used data from the Fennema-Sherman Mathematics Attitude Scales and the Mathematics Attribution Scale to look at the relationship between affective variables and cognitive outcomes in students grades 6-12. Statistically significant findings include: high-confidence students generally had higher achievement than lower-confidence students; in the sixth grade males chose other males to succeed more than females chose males; by eighth grade females chose males to succeed more than other females (indicating falling expectations); males reported more stereotyping of math as a male domain than females did; for males and females the more significant predictor of achievement was confidence; and affective variables have more influence on females' achievement and participation in mathematics than they do on males'.

Pungello, Elizabeth P., Janis Kupersmidt, Margaret R. Burchinal, and Charlotte Patterson. (1996). **"Environmental Risk Factors and Children's Achievement From Middle Childhood to Early Adolescence."** *Developmental Psychology*, Vol. 32 (No. 4), 755-767.

In analyzing the effects of family background and ethnicity, researchers found that low income and minority ethnic status stand as strong predictors of math achievement for children in grades 2-7. Math scores for children from low-income homes decreased as students got older, while those not from low-income families increased over time (thus widening the differences between the two groups). Students from ethnic minorities scored lower overall than those from European American backgrounds, regardless of family income level.

Stipek, Deborah and Heidi Gralinski. (1991). **"Gender Differences in Children's Achievement-Related Beliefs and Emotional Responses to Success and Failure in Mathematics."** *Journal of Educational Psychology*, Vol. 83 (No. 3), 361-371.

Researches looked at the achievement-related beliefs of girls and boys in third and ninth grades. A few of the findings from this study include: on average, girls expected poorer achievement on upcoming tests than boys did; a young girl's expectations for poorer achievement in mathematics can be overcome by successful performance, whereas older girls continue to expect relatively poor results; younger girls believed more than older girls that anyone could well in math if she or he tried harder; and girls were more likely to attribute failure to a lack of ability (boys most often cited difficulty of the task).

Streitmatter, Janice. (1997). **"An Exploratory Study of Risk-Taking and Attitudes in a Girls-Only Middle School Math Class."** *Elementary School Journal*, 1997.

This study of seventh- and eighth-grade students revealed higher levels of risk-taking and more positive attitudes towards math among girls in single-sex classrooms than among those in coed settings. Interviews with girls in single-sex classes showed how those students felt more freedom to ask questions and answer questions even if they were not sure they had the correct answer, displayed a greater degree of confidence in their abilities, enjoyed math class more, and were more willing to display competence in the classroom than girls in coed classes.

Tiedemann, Joachim. (2000). **"Gender-related Beliefs of Teachers in Elementary School Mathematics."** *Education Studies in Mathematics*, Vol. 41, 191-207.

Fifty-two third- and fourth-grade teachers in Germany answered survey questions regarding girls' and boys' achievement in mathematics. Teachers viewed mathematics as harder for girls than boys among equally achieving students, with boys seen as more capable of logical thinking. Teachers believed that boys could increase their success through additional effort, and that girls used more of their functional capacity for mathematics than boys do. Girls' poor mathematics test results were more often attributed to lack of ability, while boys' failures were attributed to lack of effort.

Strategies for achieving equity

Banks, James, Peter Cookson, Geneva Gay, Willis Hawley, Jacqueline Jordan Irvine, Sonia Nieto, Janet Ward Schofield, and Walter Stephan. (2001). **"Diversity Within Unity: Essential Principles for Teaching and Learning In a Multicultural Society."** *Phi Delta Kappan*, November.

Reporting the findings of the Multicultural Education Consensus Panel, the authors synthesized twelve principles for improving the policy and practice of teaching diverse children. Some of the principles include: 1) professional development programs should address issues of ethnicity, race, language, and social class; 2) the curriculum should support students' understanding that knowledge is socially constructed; 3) schools should facilitate cross-cutting groups in order to improve intergroup relations; 4) information about stereotyping and bias should be presented to students; 5) educators should help students develop the skills to interact successfully with students from different ethnic, cultural, and language groups; and 6) leaders should ensure that all schools are funded equitably.

Becerra, Ana. (2000). ***Constructivist Listening in the Classroom***. Santa Barbara, CA : Center for Educational Change in Mathematics and Science.

There is a need to create a supportive classroom environment in which students are allowed to express themselves; to listen to and be heard by others. With an explanation and focus on Dyads, and mention of Support Groups and Personal Exchange Panels, a model for constructivist listening is provided in which students may communicate in a safe space. As a paired Dyad, students have the opportunity to listen to and share ideas and feelings with classmates in an otherwise overcrowded classroom where individual attention from the teacher is hard to receive. Descriptions, guidelines, technique and recommendations are provided to institute constructivist listening in the classroom.

Bigelow, Bill, Linda Christensen, Stan Karp, Barbara Miner, and Bob Peterson, Eds. (1994). ***Rethinking Our Classrooms: Teaching for Equity and Justice***. Milwaukee, WI: Rethinking Schools. To order call: 1-800-669-4192.

Filled with ideas for transforming the curriculum, this volume helps educators infuse their teaching with tools for social justice and equity. Contributing writers come from a wide range of backgrounds and span several subject areas, including history, mathematics, literature, and social studies. Students will learn to be critical thinkers who look at the world around them from a position of questioning and activism.

Borree, Judy, Melissa Keyes, and Cindy Vaughn. (1999). ***Educating All Our Children: A Resource and Planning Guide***. Wisconsin: Wisconsin Department of Public Instruction, CESA 2, and Keyes Consulting, Inc. To order call: 608-232-7099.

"It is time to focus attention on improving the system to meet individual needs, without blaming the system, or its clients, or those who operate it." This quote from *Educating All Our Children* speaks to the main premise of the manual, which is to provide staff developers, teachers, and administrators with a comprehensive process geared towards

improving educational equity. The five phases of this process are intended to be done sequentially, and include: Team and Vision Development; Taking Stock of the Target System; Focusing and Planning the Dream; Expanding Partnerships and Implementing the Plan; and Maintaining Change or Revising the Plan.

Byrnes, Deborah and Gary Kiger, Eds. (1996). ***Common Bonds: Anti-Bias Teaching in a Diverse Society***. Wheaton, MD: Association for Childhood Education International.

Recognizing the increasing diversity in American classrooms, the authors in this book look at ways to make the classroom supportive for all students. Their goal is help teachers create an environment in which differences are celebrated while also strengthening a common set of norms among students. Chapters cover diversity relating to race/ethnicity, religion, ability differences, economic inequality, language, and gender. Each chapter provides an overview of the key issue, suggestions on how to work with students, and a case study describing a teacher's practices.

Campbell, Patricia. (1992). ***Encouraging Girls in Math and Science Series***. Washington, D.C.: U.S. Department of Education.

This set of four pamphlets aims to give school administrators, teachers, and universities the tools for evaluating their classrooms and institutions for gender equity. With a particular focus on math, science, and technology, the tips covered in these pamphlets include: using more hands-on materials in classrooms; giving girls their fair share of time and attention; debunking stereotypes students may hold about who is and isn't a mathematician; and ways for parents to help make math and science more fun and engaging for their daughters. The titles from this series are: "Math, Science, and Your Daughter: What Can Parents Do?"; Working Together, Making Changes"; "Nothing Can Stop Us Now"; and "What Works and What Doesn't?".

Campbell, Patricia. (1991). **"Girls and Math: Enough is Known for Action."** *WEEA Publishing Center Digest*, June.

Campbell covers topics such as a "math gene," gender differences in course-taking patterns at the secondary level, barriers to girls' entry into math-related careers, and the importance of intervening during key decision-making times in a girls' life (eighth and ninth grades).

Campbell, Patricia and Jennifer Storo. (1994). ***Making it Happen: Pizza Parties, Chemistry Goddesses and Other Strategies that Work for Girls and Others***. Washington, D.C.: U.S. Department of Education. Available at: http://www.campbell-kibler.com/

This booklet highlights three areas as starting points for improving the quality of education for girls in math and science - classroom climate, classroom interaction, and academic success. Advice on how to make a welcoming classroom climate includes constructing a policy about student "put downs" and watching one's own actions. Improving classroom interaction focuses on ways to encourage all students (and girls in particular) to speak up in class - provide feedback on each answer, monitor who receives teacher attention, and watch non-verbal as well as verbal messages. Making some activities fun and unusual, using multiple modes of instruction, and assuming students have a math and science future are all pointed to as ways to increase academic success.

Campbell, P. and K. Steinbrueck. (1996). ***Striving For Gender Equity: National Programs to Increase Student Engagement With Math and Science***. Washington, D.C.: American Association for the Advancement of Science.

Ten programs designed to encourage girls in math science are highlighted in this pamphlet. All of the programs are national in scope and offer research and evaluation studies on their impact. The highlighted programs are: EQUALS, Expanding Your Horizons in Science and Mathematics, FAMILY MATH, Family Science, Family Tools and Technology, GESA, Science Partnership for Girls, Operation SMART, and Playtime in Science.

Campbell, Patricia and Jennifer Storo. (1994). ***Whose Responsibility Is It? Making Coeducation Work In Math and Science: The Administrator's Role***. Washington, D.C.: U.S. Department of Education. Available at: http://www.campbell-kibler.com/

This guide begins with an assessment tool for administrators to use that uncovers where there are inequities in their schools. Pointing to scheduling as one of the main reasons girls don't take advanced math courses, the author encourages administrators to shift how they block advanced courses. School climate remains another important factor, with tools such as defining an equitable school climate and rewarding teachers for equitable classroom practices.

Carter, Samuel Casey. (2000). ***No Excuses: Lessons from 21 High-Performing, High-Poverty Schools***. Washington, D.C.: The Heritage Foundation. Available at: http://www.noexcuses.org/lessons

Termed "No Excuses schools", the schools profiled in this book refuse to make poverty an excuse for academic failure. In addition to providing detailed profiles of each of the 21 schools, the book also outlines seven common traits found at each of the institutions. These traits are principal autonomy, using measurable goals to establish a culture of achievement, master teachers, rigorous and regular testing, achievement as the key to discipline, working actively with parents, and hard work and effort.

Clewell, Beatriz Chu, Bernice Taylor Anderson, and Margaret E. Thorpe. (1992). *Breaking the Barriers: Helping Female and Minority Students Succeed in Mathematics and Science*. San Francisco, CA: Jossey-Bass Publishers.

Intended to serve as a handbook for educators, teachers, and policy makers, this book focuses on how to provide more effective educational services to minority and female students. The four sections - Promoting Participation in Mathematics and Science; Effective Intervention Strategies; Intervention Models; and Guidelines for Successful Implementation - outline the contemporary barriers to female and minority involvement in math and science, and suggest action plans designed to reduce educational disparities. An extensive list of case studies at the end of the book spotlights some of the successful programs nationwide.

Downie, Diane, Twila Slesnick, and Jean Kerr Stenmark. ***Math for Girls and Other Problem Solvers***. Berkley, CA: EQUALS Publications. To order call: 1-800-897-5036.

Through hands-on math and science activities girls are invited to see math as creative, fun, and interesting. Activities such as origami, geoblocks, horseshoe games, and spatial creatures challenges are designed to dispel the myth that math is scary or boring. With a focus on five math strands - logic strategies, breaking set, creative thinking, spatial visualization, and careers - these activities can be used with students at the elementary and secondary levels.

Durost, R.A. (1996). **"Single Sex Mathematics Classes: What and For Whom? One School's Experiences."** *NASSP Bulletin*, Vol. 80 (No. 577) 27-31.

Responding to girls' lower scores on the Maine Educational Assessment test, Presque Isle High School educators established an all-girls Algebra I course. After a pilot test of the class with a group of randomly selected girls, test scores revealed marked improvements in the girls' scores. Other positive outcomes from the class include a higher percentage of girls later enrolling in mathematics classes, increased self-confidence, and more girls considering a math-related career. The course is now an elective and is open to boys as well as girls (although no boys had enrolled in the course when the article was printed).

Education Trust. (1999). *Dispelling the Myth: High Poverty Schools Exceeding Expectations.* Washington, DC: Author. Available at: http://www.edtrust.org/main/reports.asp

Title 1 was made into law in 1994 by the U.S, Congress with the intent to provide high poverty schools with low-achieving students with the necessary aide to equalize academic achievements throughout the nation. Evaluating schools with a poverty level of over 50% that were identified by their state as top scoring and/or most improved, Education Trust observed common strategies used to increase achievement: (1) State standards were used to design curriculum and instruction, assess student work, and evaluate teachers. (2) Instructional time in reading and math increased in order to reach standards. (3) A larger portion of funds was devoted to support professional development focused on changing instructional practice. (4) Comprehensive systems were implemented to monitor individual student progress and provided extra support to students as needed. (5) Focused efforts to involve parents in helping students meet standards were begun. (6) State or district accountability systems that have real consequences were in place for adults in the schools.

Fashola, Olatokunbo, Robert Slavin, Margarita Calder n, and Richard Dur n. ***Effective Programs for Latino Students in Elementary and Middle Schools***. Available at: http://www.csos.jhu.edu/crespar/Reports/report11entire.htm

The lower average academic achievement and higher dropout rates of Latino students (as compared to non-Latino White students) prompted this study, which looks at elementary and middle school programs that have proven successful at engaging Latino students. The successful mathematics programs profiled include: Comprehensive School Mathematics Program (CSMP), Cognitively Guided Instruction (CGI), Project SEED, Skills Reinforcement Project, and Maneuvers With Mathematics. Many of these programs emphasize problem solving, real-life contexts for mathematical tasks, and conceptual thinking.

Franklin, Margaret.(Research and Planning Center, University of Nevada). (1990). ***Add-Ventures for Girls: Building Math Confidence***. Newton, MA: WEEA Publishing Center. To order call: 1-800-225-3088.

Each of the eighteen sections of *Add-Ventures* begins with a summary of the relevant research, then moves into strategies, activities and resources educators can employ to help build the math confidence of their female students. Activities span both primary and intermediate grades. For example, the first chapter - Attitudes and Math - reviews some of the literature that points to girls' lower self-confidence in math. A list of twelve strategies to combat this discrepancy follows, with ideas such as recognizing students' math achievements, creating opportunities for cooperative learning, and using girls as peer tutors in math. Math activities, handout, and worksheets (such as Guesses Galore, More or Less Game, and I am the Greatest! Game) supplement this information and provide teachers with materials they can use in their classrooms. An annotated resource list rounds out the chapter.

Giecek, Tamara Sober. (2000). ***Teaching Economic As If People Mattered***. Boston, MA: United for a Fair Economy. To order call: 617-423-2148.

This high school curriculum guide provides real-world contexts for helping students consider the current economic climate. Lesson cover income levels, the widening pay gap, what is wealth, globalization, taxes, savings and stock accounts, racial and gender gaps, and economic inequality. A wide range of mathematics content is included.

Grayson, Dolores A. and Mary D. Martin. (1997). ***Generating Expectations for Student Achievement: A Teacher Handbook***. Canyon Lake, CA: GrayMill Publications. To order call: 1-800-218-GESA.

Designed to help teachers assess their classroom practices, interactions with students, and curriculum materials, GESA contains five units that are each practiced from two weeks to a month. Each unit contains: (1) an area of disparity (instructional contact; grouping and organization; classroom management/discipline; self-esteem; evaluation of student performance); (2) information on interactions (response opportunities and feedback; wait time and physical closeness; touching and reproof; listening and probing; and higher level questioning and analytical feedback); and (3) curriculum related issues (evaluating materials for bias; math, science, and technology; multicultural/pluralistic resources; gender/race/ethnic balance in history; and physical activity and sexuality).

Haycock, Kati. (1998). **"Good Teaching Matters A Lot."** *Thinking K-16*. Vol. 3 (No. 2), 3-14. Available at: http://www.edtrust.org/pubs-online.html

Sponsored by the Education Trust, this article looks at data from Tennessee, Texas, and Massachusetts to determine which factors help improve achievement for low-achieving students. In all three locations, the gap between the highest and lowest achievers closed after being in a classroom with a very effective teacher. For example, in Boston researchers tracked students with different teachers who started the year with similar achievement. In math the top third most effective teachers produced gains that on average exceeded the national average, whereas the bottom third showed no growth. Factors contributing to teacher effectiveness include strong verbal and math skills (as measured by scores on teacher skills exams) and deep content knowledge (e.g. a degree

in math and science). The article closes with some strategies for improving teacher effectiveness: standards for entry into the profession that align with state K-12 standards; accountability measures for colleges that prepare teachers; professional development for existing teachers; providing poor students and students of color with teachers as qualified as those of other students; parent right to know policies; and recruitment and rewards that attract the best.

Horgan, Dianne. (1995). ***Achieving Gender Equity: Strategies for the Classroom***. Boston: Allyn and Bacon.

With a mix of background research and practical tools for creating a more equitable classroom, this book aims to help teachers change their classroom practices so that girls and boys develop the self-confidence and skills necessary to be successful in school. The first two chapters lay out a context for educational equality, citing patterns such as more teacher attention for boys, subtle messages that discourage girls from mathematics, inequitable teacher expectations, and the role of family and peers in providing early learning experiences. Chapter three lists thirteen strategies that teachers can employ to create a more equitable classroom. Some of these include: perform a gender bias audit of the classroom; encourage risk taking; provide good feedback; retrain attributions; and use groups effectively. Each strategy is accompanied with background information, questions/scenarios for discussion and writing, and other tools for self- and classroom assessment. The final chapter talks about dealing with parents.

Jarrett, Denise. (1999). **"The Inclusive Classroom: Mathematics and Science Instruction for Students with Learning Disabilities."** Portland, OR: Northwest Regional Education Lab. Available at: http://www.nwrel.org/msec/book7.pdf

As the movement towards mainstreaming students with disabilities into general education classrooms grows, this report offers important suggestions on ways to extend standards-based mathematics and science curriculum to include multiple learning styles. Topics covered include classroom arrangement, cooperative learning, peer tutors, assessment, family involvement, inquiry-based learning, vocabulary acquisition, problem solving, calculators and computers, and textbook adaptations. The author provides concrete strategies for addressing each of these topics, tapping into various modalities for learning (e.g. visual, kinesthetic, and auditory adaptations).

Karp, Karen, Todd Brown, Linda Allen, and Candy Allen. (1998). ***Feisty Females: Inspiring Girls to Think Mathematically***. Portsmouth, NH: Heinemann. To order call: 1-800-225-5800.

In an effort to combat girls' declining interest and confidence in mathematics, the authors of this book link mathematical learning to literature containing strong female role models. They offer tips on how to explore the following four mathematical areas using literature-based materials: number and computation; geometry and measurement; probability and statistics; and algebraic ideas. Includes descriptions of lessons in real classrooms and suggestions for assessment.

Koelsch, Nanette, Elise Trumbull Estrin, and Beverly Farr. (1995). ***Guide to Developing Equitable Performance Assessments***. San Francisco, CA: WestEd. To order call: 415-565-3044.

Recognizing that each student brings her own background to the classroom, the authors point out the shortcomings of using one assessment for all students. When a gap exists between a student's point of reference and the task being evaluated, oftentimes the student will score lower than if the problem had been located in a context she was familiar with. Using relevant content references and allowing students to demonstrate their knowledge in a culturally appropriate way are two strategies teachers can utilize to create equitable assessments.

Kluth, Paula and Diana Straut. (2001). **"Standards for Diverse Learners."** *Educational Leadership*, Sepember.
All of the attention paid to standards will mean little if educators and policymakers do not consider the increasingly diverse nature of the U.S. school-age population. The authors offer five conditions to make standards-based education inclusive of all children: 1) standards are developmental and flexible; 2) standards require a wide range of assessment tools; 3) standards allow equitable access to meaningful content; 4) it takes a community to implement standards; and 5) standards are a catalyst for other reforms.

Krueger, Alan and Diane Whitmore. (2001). **"Would Smaller Classes Help Close the Black-White Achievement Gap?"** Working paper #451, Princeton University. Available at: http://www.irs.princeton.edu/pubs/pdfs/451.pdf

This study of students who participated in Tennessee's Project STAR program showed achievement increases for all students in smaller classes as compared to those in a regular size classes. African American students gained the most (as evidenced by standardized test scores) from reduced class size. The researchers estimated that if all students K-3 were in smaller classes for one to four years the Black-White achievement gap would close by 38% in grades K-3 and by 15% after that. The gap in scores on college entrance exams also narrowed for students in smaller classes.

Lachat, Mary Ann. (1999). ***Standards, Equity, and Cultural Diversity***. Providence, RI: Northeast and Islands Regional Educational Laboratory at Brown University. Available at: http://www.lab.brown.edu

With the implementation of education reform initiatives nationwide, questions arise regarding how these standards impact students from diverse ethnic and linguistic backgrounds. The author calls for teachers and administrators to infuse information on culturally diverse populations into their standards-based professional development efforts. She also points to the ways in which students whose first language is not English can benefit from reform curriculum and instruction, and to the cautions that go with implementing such curricula.

Lee, Enid, Deborah Menkart, Margo Okazawa-Rey, Eds. (1998). ***Beyond Heroes and Holidays: A Practical Guide to K-12 Anti-Racist, Multicultural Education and Staff Development.*** Washington, D.C.: Network of Educators on the Americas.

This collection includes essays from teachers, staff developers, and researchers, as well as classroom activities that promote anti-racism and multicultural education. Classroom lessons in early childhood, social studies/language arts, mathematics, science and geography, the arts, and technology provide a many ideas for teachers to use in their

classrooms. A section on school staff, family, and community development provides activities and readings that can be used during equity workshops.

McIntyre, Ellen, Ann Rosebery, and Norma Gonz lez, Eds. (2001). ***Classroom Diversity: Connecting Curriculum to Students' Lives***. Portsmouth, NH: Heinemann.

The eleven essays in this book aim to provide educators with lesson plans and tools for teaching diverse student populations. Taking a "sociocultural" approach to curriculum design, the authors use students' own household experiences and cultures (together referred to as "funds of knowledge") as the starting point for classroom instruction. Examples of teachers working with students from many ethnic backgrounds - African American, Haitian American, Latino, Native American, and rural White - illustrate some starting points for rethinking curriculum design. Some of the essay titles include: "Unearthing the Mathematics of a Classroom Garden"; "The Sound of Drums"; "Creating Learning Communities: The 'Build Your Dream House' Unit"; and "Ring My Bell: Contextualizing Home and School in an African American Community."

Midwest Consortium for Mathematics and Science Education. (1998). ***Connecting With the Learner: An Equity Toolkit***. Oak Brook, IL: North Central Regional Educational Laboratory. To order call 1-800-356-2735.

The six sections in this toolkit cover classroom practice, curriculum, instructional strategies, model programs, the meaning of educational equity, and personal beliefs. With a focus on mathematics and science, it provides activities, resources and information to facilitators interested in working on equity with teachers, schools, and districts. A few activities in the toolkit are: "To us equity means "; "What would I feel like if "; "Style: Mapping Preferences in Learning"; and "Building Bridges Through Classroom Interventions."

National Alliance for Partnerships in Equity. ***System-Building Standards for Education Reform: An Equity Perspective***. Washington, D.C.: Author. Available at: http://www.napequity.org/standards.html

The National Alliance for Partnerships in Equity (NAPE) has identified ten essential system-building standards designed to address current inequities. The standards cover educational environment, issues of governance, pre-service and in-service education, teaching practices, assessment practices, curricular materials, individualized educational planning, allocation of financial resources, data collection and accountability, and partnership building. Each area contains a list of indicators teachers, administrators, and other concerned about educational equity can use as a guideline in looking at whether or not classrooms, schools, and school systems are equitable.

National Coalition of Girls' Schools. ***Girls and Technology: an Idea Book***. Concord, Massachusetts: Author. To order call: (978) 287-6014.

Chock full of ideas on how to encourage girls to use technology effectively, this book is the product of a multi-day conference on girls and technology. It contains tips for parents and educators, sample lesson plans, a bibliography, an index of girl-friendly web sites and computer games, and a list of resource organizations.

National Urban League. (1999). **"Science and Math Are for Girls!"** On-line. [http://ericps.ed.uiuc.edu/npin/respar/texts/parschoo/scimath.html].

Offers tips such as: insisting that girls take math and science courses every year; providing after-school activities; pairing girls with positive role models in math and science; and holding high expectations for all girls.

O Dell, Lynn. (2001). **A Math Class of their Own.** *Los Angeles Times*, January 10.

A pilot program has been developed to determine whether girls learn math better in single-gender classes. Although no statistical analysis has been performed, girls in the single-gender classes seem to perform better then if they had been in a mixed gender class. Single gender classes are thought to improve math achievement because they provide a more encouraging and comfortable environment in which girls are more confident and less inhibited to ask questions at the risk of embarrassment.

Powell, Mary Jo. (1994). ***Equity in the Reform of Mathematics and Science Education: A Look at Issues and Solutions***. Austin, TX: Southwest Educational Development Laboratory. To order call 512-476-6861

This comprehensive guide is intended to be used as a reference for individuals and organizations working to change educational policy and practice. The first section looks at some definitions of equity and its general role in education reform. The next section covers related topic areas, such as language, school structure, resources, teacher expectations and behaviors, curriculum, and assessment. Strategies for achieving equity comprise the third part, which describes programs and activities geared toward girls, students of color, English as a Second Language learners, and rural students, and also profiles successful school reform models.

President s Advisory Commission on Educational Excellence for Hispanic Americans (September 2000). ***Creating the will: Hispanics achieving educational excellence.*** A report to the President of the United States, the Secretary of Education, and the nation.

Hispanic children are the fastest growing population in the United States but are disproportionately behind their peers when it comes to educational achievement. By providing concrete strategies, this report stresses the need for a collective effort to raise the performance and advancement of Hispanic students to that of the same level of achievement as other students in the country. An outline of the current status for Hispanics at each level of education, from pre-school through graduate and professional development is provided. Recommendations are made for what role schools, parents, community-based organizations, government and the private sector can play to aid the advancement and inclusion of Hispanics at each level to close the educational achievement gap. An emphasis is placed on the urgency to create and foster a (political) will and vested interest to do this work for the betterment of the county on the whole by investing in the future of all children.

Reis, Sally M. and M. Katherine Gavin. (1999). **"Why Jane Doesn't Think She Can Do Math: How Teachers Can Encourage Talented Girls in Mathematics."** In Linda Jensen Sheffield (Ed.) *Developing Mathematically Promising Students*. Reston, VA: National Council for Teachers of Mathematics.

Though this article focuses on higher achieving girls, many of the issues discussed and strategies provided are applicable to all students. It lists six strategies to help educators encourage girls in mathematics: (1) provide a safe and supportive environment; (2) assume personal responsibility to encourage talented females; (3) employ instructional strategies that address the characteristics of females; (4) use language, problems, and activities that are relevant to girls; (5) create a challenging curriculum that promotes deep mathematical thinking; and (6) provide female role models and mentors for girls.

Rousso, Harilyn & Michael Webmeyer., Eds. (2001). ***Double jeopardy: Addressing gender equity in special education***. Albany, NY: SUNY Press.

Girls and young women with disabilities are faced with discrimination and inequities in the education system. In comparison to disabled male counterparts or non-disabled females, disabled women are less likely to achieve equivalent vocational success upon leaving school. Issues such as biased curricula and inequitable student-teacher interactions are analyzed. Strategies and innovative programs are highlighted to help empower disabled youth.

Sanders, Jo, Janice Koch, and Josephine Urso. (1997). ***Gender Equity Right From the Start.*** Mahwah, NJ: Lawrence Erlbaum Associates.

This compilation of 192 activities for educators to use with pre-service teachers represents the fruits of the Teacher Education Equity Project. Subject areas covered in the book are: Mathematics, Science, and Technology as Male Domains; Peers', Teachers', Parents', and Society's Cultural Expectations; Biased and Inappropriate Curriculum Materials; Classroom Interaction and Atmosphere; Anti-Intellectualism and Attributional Style; and Testing and Assessment. While the instructional activities were designed for use with pre-service teachers, many of the topics covered would also be useful to in-service educators.

Sanders, Jo. (1994). ***Lifting the Barriers: 600 Strategies That Really Work to Increase Girls' Participation in Science, Mathematics, and Computers***. Port Washington, NY: Jo Sanders Publications. To order call: (206) 285-9317.

Born out of the Computer Equity Expert Project, this list of strategies to increase girls' participation in math, science, and technology came from the 200 K-12 educators who participated in the project. The author pulled together the educators' suggestions and experience into this concise guide of 600 strategies. Topic areas include (but are not limited to): curriculum, extra-curricular clubs, mentoring, field trips, parents, role models, scheduling, and teaching techniques. Most strategies are described in one or two sentences, and can be applied to a particular school's or classroom's situation.

Stitt, Beverly. (1988). ***Building Gender Fairness in Schools***. Illinois: Southern Illinois Press.

With the goal of helping educators and pre-service teachers identify and eliminate gender bias from their classrooms and schools, this book is divided into two sections - readings (research) and eleven units of instruction. Teachers follow the eleven units and learn about ways to change their classroom practices. A sample of the instructional units are: identify personal gender biases; use gender-fair verbal interaction with students; identify

gender-fair curriculum materials; and plan activities to recruit and retain nontraditional students.

Strauss, Valerie. (2000). **"Equal Opportunity Learning: Gender Differences Prompt Teachers to Try Tactics Geared to Both."** from *Washington Post*, February 22, pp. A09.
This slant on gender differences argues that schools are structured to favor the learning styles female students. Teachers should therefore use a variety of instructional techniques to reach students with diverse strengths. In this article teachers had students work in small groups, allowed students to choose from a variety of assignments and work at their own pace, permitted movement around the classroom, and required students to wait five seconds before raising their hands to answer a question.

United Connecticut for Women in Science, Mathematics, and Engineering. **"A Dozen Ideas for Encouraging Girls in Math and Science."** West Hartford, CT: Author.
Geared toward parents, this guide provides easy-to-implement strategies for engaging girls in math and science. Some of the items on the list include: talk about math and science; do math and science activities together; monitor course choices; find out about informal learning opportunities; build things together; and provide role models.

United States Department of Education. ***What Schools Can Do to Improve Math and Science Achievement by Minority and Female Students***. Washington, D.C.: Author. To order call: 1-877-4-ED-PUBS
This booklet targets successful strategies teachers, principals, counselors, parents, and school districts can utilize to close the gaps in achievement in math and science. Some of the strategies listed are: hold high expectations for all students; respond as fully to the comments of minority and female students as other students; monitor achievement of all students on a daily basis; communicate belief in the potential of minority and female students in math and science; encourage different approaches to problem solving; accept differences that minority and female students may bring to the classroom; and construct math word problems that are relevant to students.

Weissglass, Julian. (1998). ***Ripples of Hope: Building Relationships for Educational Change***. Santa Barbara, CA: Center for Educational Change in Mathematics and Science.
Building upon the idea that classrooms can be caring places where a community of learners gather, this book offers strategies for leaders to implement that will help make their schools more effective places of learning for more students. In addition to providing tools for educational change, this work looks at the reasons for past failures and larger underlying structural issues. The materials presented contain perspectives on equity and class.

Williams, Belinda & Woods, Michele (April 1997). **Building on Urban Learners Experiences**. Educational Leadership, vol. 54, (No. 7), pp. 29-32.
The Urban Education Project of Research for Better Schools has developed an Urban Learner Framework to emphasize the abilities and strengths of urban learners who are stereotypically thought to be unmotivated and inherently at risk. The Urban Learner

Framework uses the learners experience including influences from school, home, and the community to affect students learning. By identifying connections through out of school experiences information can be gathered that helps teachers reach their students in a meaningful way. To develop meaningful instruction it is important to identify what is important to students; to make a connection between the students experiences and the curriculum content; to begin lessons with an activity that connects the strengths of students and build on that with their experiences; and reflect on the instructional experience for consideration for change.

Electronic Resources

Internet, CD-ROM, Video

"The Achievement Gap." **http://www.edweek.org/sreports/gap.htm**

Despite decades of attention, gaps in the achievement of minority students remain one of the most pressing problems in education. In this four-part series, *Education Week* asks: Why do achievement gaps persist? Reasons for the achievement gap are covered ranging from dumbed-down curriculum for students of color to peer pressure on not appearing too White to less qualified teachers. Some successes are also highlighted, including smaller gaps in achievement rates for students at schools run by the Pentagon and increasing the number of advanced courses offered in some urban schools.

American Association for the Advancement of Science. **http://ehrweb.aaas.org/ehr/pubs.htm**

The AAAS provides a guide to publications on-line that can be accessed at no cost. The Environmental Checklist, "How Would I Handle That?" equity vignettes, and an article on moving equity from the margin into the center of education are especially worth noting.

Civil Rights Project at Harvard University, Conference on Minority Issues in Special Education. **http://www.law.harvard.edu/civilrights/conferences/SpecEd/exsummary.html**

In reviewing the research surrounding the relationship between special education and students of color, several key issues emerged at this conference. African American boys in particular are overrepresented in special needs classes. Minority students are more likely than White students to be placed in restrictive learning environments. Latino students are increasingly placed in special education. Students of color are less likely than White students to receive counseling after their initial placement into special education. When minority students with disabilities are required to take high-stakes tests they fail at higher rates than their non-disabled peers and do not receive adequate preparation for the exams.

Community Learning Network. **http://www.cln.org/cln.html**

CLN is designed to help K-12 teachers integrate technology into their classrooms.

Connecting the Past With the Future: Women in Mathematics and Science Video
Curriculum Publications Clearinghouse - Western Illinois University
Macomb, IL 61455
Phone: 800-322-3905

This series of four videos details the historical contributions of women in mathematics and science, discusses career choices, and provides contemporary role models for girls.

"Classroom Interactions", UC Davis, *Creating Gender Equity in Your Teaching.* **http://www.engr.ucdavis.edu/college/information/gender/hand3.html**

Covers a variety of classroom interactions and points out ways to ensure that those interactions are equitable.

EducatingJane.com. **http://www.educatingjane.com**

This site is for the positive intellectual and social development of girls so that they can be successful. It s replete with female role models, current news articles of issues that affect girls and links to explore academic interests. Geared mostly towards girls, the site also has resources for parents and educators.

Educational Resources Information Center (ERIC). **http://ericeece.org/index.html**

ERIC is a national information system designed to provide users with access to an extensive body of education-related literature. The site contains a conference calendar, links for parents, a searchable database of publications, and web resources on many areas of education.

Education Week and *Teacher Magazine*. **http://www.edweek.org**

The on-line versions of these two popular magazines contain articles, links to a variety of issues in education, and an archive of past issues.

Eisenhower National Clearinghouse Teacher Change. **http://change.enc.org/**

This project is a collection of resources to help educators and professional development providers facilitate discussion and reflection on improving K-12 mathematics. The materials include professional development activities, TIMSS publications, articles about teacher change, and teacher narratives.

ENC Focus "Making Schools Work for Every Child." **http://www.enc.org/focus/equity/0,1950,,00.shtm**

What kinds of classrooms and programs help educators to reach all students? What unique ways can teachers explore engaging students with particular needs? These articles on the theme of equity for all cover a range of issues in the standards-based classroom. Contributors cover equity issues relating to cooperative groups, elementary math and science classrooms, technology, language diversity, and gender parity.

ENC Focus "Teaching in the Standards-Based Classroom." **http://www.enc.org/focus/standards/0,1950,,00.shtm**

What does a standards-based classroom look like? How has it affected teachers and students? Learn how to optimize the curriculum to meet several standards in one lesson, how to enhance the effectiveness of learning groups, and how to create a standards-based classroom. Articles on systemic reform, inquiry-based learning, assessment, and technology are included.

Engineer Girl. **http://www.engineergirl.org**

The National Academy of Engineering has developed a site geared towards girls, to promote and foster interest in becoming an engineer. The site highlights the different types of engineering and how they relate to and effect everyday life. There are lots of cool facts and reasons to become an engineer.

Equity Education On-line. **http://www.etdc.wednet.edu/equity/index.html**

The five areas on this web site - organizations, research, student actions and organizations, equity tools and materials, and state resources - link to an array of resources related to equity.

"Equity is More Than Coping With Change." **http://ra.terc.edu/alliance/template/state_connections/nh/nh-equity/toc.html**

Written by a team of educators from New Hampshire, the Equity Handbook provides insights and strategies for teachers to use in the classroom that will help build a more equitable atmosphere. Issues of gender, race/ethnicity, language, class, and special needs are all covered. The chapters include: Educator Expectations; Classroom Practice: Curriculum, Instruction, Pedagogy and Assessment; Professional Development; and Theory and Research Concerning Equity in Math and Science Education.

"Equity Self-Evaluation and Planning Document." **http://equity.enc.org/equity/eqtyres/erg/111584/1584.htm**

Used periodically, and at least annually, this audit can be used to assess the performance of a school district, school or program in meeting the needs of all its students. The audit details disparities between the sexes and among various racial, ethnic and language groups in terms of academic achievement, resource distribution and representation in special programs.

"ERASE (Expose Racism and Advance School Excellence) Factsheet." **http://www.arc.org/Pages/Efactsheet.html**

This up-to-date factsheet sheds light on some of the persisting disparities in education. Some statistics from the factsheet include: (1) the proportion of Latino and African-American students in segregated schools is rising, not falling; (2) the most intense school segregation happens in the North and in large central cities; and (3) teachers in poor schools earn much less - 28% less on average - than those in richer schools.

"Examining Beliefs and Defining Equity." **http://equity.enc.org/equity/selfeval/index2.htm**

The eight activities on this part of ENC's "Making Schools Work for Every Child" web site and CD-ROM help educators self-assess their beliefs about equity. Among the activities are an "equitable school" walk, a comparison of the terms *equity*, *equality*, and *excellence*, and a survey designed to probe individual's beliefs about who can learn math and science.

"Facing the Consequences: An Examination of Racial Discrimination in U.S. Public Schools." **http://www.arc.orc/erase/FTC1intro.html**

Gathering data from 12 cities around the U.S., the Applied Research Center compiled this report which analyzes some of the critical issues for students of color in public schools. Eleven of the twelve cities failed the "report card"; the twelve received a "D". Key findings include: African Americans, Latinos, and Native Americans are suspended or expelled at higher rates than their peers from other racial groups; students of color are more likely to drop out or be pushed out of school; students of color have less access to

advanced classes; and the racial composition of teachers rarely reflects that of the student body.

Gender Equity in the Classroom Video
WGBY57
44 Hampden St.
Springfield, MA 01103
Phone: 800-639-8879

David Sadker hosts this hour-long video that steps inside three classrooms to investigate inequitable teaching practices. Strategies for creating a more equitable classroom are detailed at the end of the video.

Girls and Technology Video. **http://www.ncgs.org/Pages/publi.htm**

This video created by the National Coalition of Girls' Schools presents information and teaching tips for educators and parents that focus on girls and technology.

Girls Can! Video. **http://www.aauw.org/home.html**
Phone: 800-225-9998, X 459

Complement to Shortchanging Girls, Shortchanging America, this video looks at programs around the country that are making a difference in fighting gender bias in schools.

"Girls Byte Back". **http://www.teachermagazine.org/tm/vol-10/07girls.h10**

Girls' Middle School provides a single-sex education to girls in Mountain View, California. With an emphasis on math, science, and technology, the schools aims to academically challenge its students while also meeting their emotional needs.

"Girls: If I m a good student overall, I can t be good at math ". **http://www.stanford.edu/dept/news/report/news/february10/mathpath210.html**

This article covers some of the psychological factors impacting girls and mathematics achievement.

Integrating Gender Equity and Reform (InGear). **http://www.coe.uga.edu/ingear/**

This web site is a compilation of curriculum materials that promote excellence and equity in mathematics, science, and engineering instruction. Includes background information, instructional resources, teaching strategies, and curricula.

"In This Issue: High Poverty, High Performing Schools." **http://www.idra.org/Newslttr/1997/Jun/Zarate.htm**

Debunking the myth that high poverty equals low performance in schools, this series of articles looks at some of the strategies used in poverty-stricken schools that have successfully raised student achievement. Parental involvement, challenging curriculum, technology labs, high expectations for all students, celebrating diversity, and creating a nurturing environment were all given as successful strategies.

Making Schools Work for Every Child CD-ROM

Eisenhower National Clearinghouse for Mathematics and Science Education
1929 Kenney Road
Columbus, OH 43210-1079
Phone: 614-292-7784

This CD-ROM available free of charge tackles a variety of issues related to equity. It also offers examples of innovative programs, real-life stories, information on professional development and self-assessment, and full-text copies of related articles.

Massachusetts Gender Equity Centers. **http://www.genderequity.org/index.html**

This site features TechTalk for female students, a list of women role models, games, events, and links for parents, educators, and young women.

The Math Forum. **http://forum.swarthmore.edu/**

The Math Forum links to many areas of math education, including curriculum, lesson planning, reform, constuctivism, equity and access, Ask Dr. Math, organizations of interest, resources for parents, and a discussion area for teachers.

Mentornet. **http://www.mentornet.net**

The National Electronic Industrial Mentoring Network for Women in Engineering and Science is a website that links women engineering students with volunteers in the industry, to promote and development the careers of women in math, science, and engineering fields.

Mid-continent Regional Educational Laboratory. **http://www.mcrel.org/resources/plus/**

"Connections+" consists of Internet resources - lesson plans, activities, curriculum resources - linked with corresponding subject-area content standards.

Multicultural Pavilion. **http://curry.edschool.virginia.edu/go/multicultural/**

The Multicultural Pavilion offers educators a host of resources to support a multicultural classroom. Proverbs, songs, research articles, poetry, lesson plans, and other tools cover an range of classroom ages and subject areas.

National Center for Education Statistics. **http://www.ed.gov/NCES/search.html**

The NCES offers a searchable database of education statistics, with the opportunity to order many publications for free.

National Clearinghouse for Comprehensive School Reform. **http://www.goodschools.gwu.edu/pubs/book/jul01.html#2**

This collection of articles and tools provides teachers and administrators with a variety of resources related to school reform. Topics include reforming schools to meet the needs of an increasingly diverse student body, supporting students with special needs, creating rich learning environments for English language learners, and building upon school reform methods that provide access to all students.

"No Room at the Top for Women in Education." **http://www.sfgate.com/cgi-bin/**

article.cgi?file=/examiner/archive/1999/10/10/NEWS14475.dtl
Leading off with the fact that while women comprise nearly 80 percent of the nation's teachers they account for only 10 percent of the superintendents of leading public school systems, the article delves into some of the reasons behind this disparity.

North Central Regional Educational Laboratory. **http://www.ncrel.org/ncrel/sdrs/areas/issues/content/cntareas/math/ma100.htm**
"Critical Issue: Ensuring Equity and Excellence in Math" is the topic of this site that contains a brief overview of equity issues in mathematics as well as action items for promoting equity.

Program for Gender Equity - NSF. **http://www.ehr.nsf.gov/ehr/hrd/ge/ge-index.htm**
This National Science Foundation program targets the underrepresentation of women and minorities in mathematics, science, and engineering. The web site contains guidelines for submitting grant proposals to the program, a listing of current and past awardees, and links to a variety of equity resources.

Profile of an Equitable Math and Science Classroom and Teacher (VISMT). **http://equity.enc.org/equity/eqtyres/erg/111583/1583.htm**
The profile lists the traits of an equitable math and science classroom in the areas of: physical environment, curriculum, language, teaching methodology, behavior management, academic evaluation, and classroom integration.

"Quick Takes." **http://www.sedl.org/scimath/quicktakes/**
The Southwest Educational Development Laboratory has created this series of briefs of various issues in education. Titles include "Tracking Decisions Change Lives," "Calculators in the Classroom," and "Using the TIMSS Report."

"Reaching the Top: A Report of the National Task Force on Minority High Achievement." The College Board. **http://www.collegeboard.org/**
This report looks at the shortage of high-achieving minority students and proposes a plan of action - termed "affirmative development" - to help address this issue. A wide range of subject areas is covered, as well as an analysis of overall school structures. Copies of the report can be downloaded from the web site.

The Regional Alliance HUB. **http://ra.terc.edu/alliance/HubHome.html**
The Hub will connect you with information on these and other topics: equity, assessment, informal education, school reform, professional development, science, and technology. It also offers several on-line communities, a calendar, and a description of the project's work.

Research for Better Schools. **http://www2.rbs.org**
Research for Better Schools operates the Mid-Atlantic Eisenhower Regional Laboratory. The web site features links to resources for curriculum, professional development, equity, events, and news.

Through the Glass Wall. **http://www.terc.edu/glasswall/**

This project has looked at how girls and boys play mathematical computer games in order to describe what makes a good mathematical and equitable computer game. The web site includes descriptions of over 60 games.

"Where the Girls Are." **http://www.teachermagazine.org/ew/vol-16/01sadker.h16**

David Sadker comments on the current disparities between girls and boys in math, in areas such as standardized testing, college degrees, and career choices.

Women in Nontraditional Careers Videos. http://www.herownwords.com
Her Own Words
PO Box 5264
Madison, WI 53705-0264
608-271-7083

The ten 15-minute videos and ten resource guides on women in nontraditional careers are: Women in Construction, Women in Dentistry, Women in Engineering, Women in Firefighting, Women in Machining, Women in Nontraditional Careers: An Introduction, Women in Policing, Women in Welding, Women Talk: Women in Nontraditional Careers in Their Own Words.

Organizations

The Achievement Council
3460 Wilshire Blvd., Suite 420
Los Angeles, CA 90010
Phone: 213-487-3194 Fax: 213-487-0879
Web site: http://www.achievementcouncil.org

The Achievement Council is a non-profit, public interest organization whose mission is to examine and address the systemic challenges which have led to low academic outcomes for urban and low income students, and to help build the capacity of districts, schools, and communities to ensure that all students are academically prepared to succeed at the highest levels - including graduation from a four-year college or university.

Algebra Project
99 Bishop Richard Allen Drive
Cambridge, MA 02139
Phone: 617-491-0200
Web site: http://www.sirius.com/~casha/

This program aims to help students in the inner city and rural areas become mathematically literate by using students' real-life experiences as the basis for exposing them to algebraic concepts. The five-step curricular program designed for sixth-graders moves students from familiar concrete experiences to abstract mathematics.

American Association for the Advancement of Science
Directorate for Education and Human Resources Programs
1200 New York Avenue, NW
Washington, D.C. 20005
Phone: 202-326-7019 Fax: 202-371-9849
Web site: http://www.aaas.org

In addition to providing technical assistance to school districts and other groups that work with children, AAAS operates Project 2061, a K-12 educational reform to improve science and technology literacy for all citizens.

American Association of University of Women Educational Foundation
1111 16th Street, NW
Washington, D.C. 20036-4873
Phone: 202-728-7628 Fax: 202-463-7169
Orders: 800-225-7169
Web site: http://www.aauw.org

Offers a variety of print materials and on-line resources related to gender equity. Issue areas include affirmative action, education, sexual harassment, reproductive rights, and athletics, among other things. Produces research publications such as *How Schools Shortchange Girls*, *Growing Smart: What's Working for Girls*, and *Gender Gaps: Where Schools Still Fail Our Children.*

American Mathematical Society
P.O. Box 6248
Providence, RI 02940-6248

Phone: 401-455-4083 Fax: 401-331-3842
Web site: http://www.ams.org

Prints a variety of publications on mathematics. Sponsors a web site with information on recent news related to math, career resources, reports, and an electronic journal.

Anti-Defamation League (ADL)
823 United Nations Plaza
New York, NY 10017
Web site: http://www.adl.org

The Anti-Defamation League works to fight anti-Semitism, hatred, bigotry, and prejudice in schools and in society as a whole. The Educational Policy and Programs Department conducts research in the area of prejudice and evaluates the effectiveness of strategies designed to combat prejudice. It develops anti-bias curriculum and programming for use by classroom educators and acquires or develops multicultural materials designed to enhance the respect and understanding accorded Jews and other minority groups.

Applied Research Center
3781 Broadway
Oakland, CA 94611
Phone: 510-653-3415 Fax: 510-653-3427
Web site: http://www.arc.org

The Applied Research Center is a public policy, education, and research institute that emphasizes issues of race and social change. Among the projects at ARC is the ERASE Initiative - a national program that challenges racism in public schools and promotes racial justice and academic excellence for all students.

Association for Supervision and Curriculum Development (ASCD)
1703 North Beauregard Street
Alexandria, VA 22311
Phone: 1-800-933-ASCD Fax: 703-5755400
Web site: http://www.ascd.org

Founded in 1943, ASCD's mission is to forge covenants in teaching and learning for the success of all learners. Throughout the year in cities around the globe, ASCD offers conferences and meetings on emerging issues, and professional training opportunities for educators. The organization distributes a variety of journals, newsletters, books, and audio- and videotapes. Through affiliate activities, networks, student chapters, alliances, and strategic partners, ASCD seeks to broaden their reach to effectively pursue their mission and goals. Issues of equity and diversity are important components of ASCD's work, and are represented in their conferences and publications.

Campbell-Kibler Associates
Groton Ridge Heights
Groton, MA 01450
Phone: 978-448-5402
Web site: http://www.campbell-kibler.com

For the past 25 years Dr. Patricia B. Campbell of Campbell-Kibler Associates has been doing research and evaluation to increase gender and race equity in math, science and technology education. Results of her work can be found in a variety of "user friendly" brochures and pamphlets that can be downloaded from the web site.

Center for Gender Equity
Washington Research Institute
150 Nickerson Street, Suite 305
Seattle, WA 98109
Phone: 206-285-9317 Fax: 206-285-1523
Web site: http://www.wri-edu.org/equity/gender.html

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.

Center for Research on Education, Diversity, and Excellence (CREDE)
University of California, Santa Cruz
1156 High Street
Santa Cruz, CA 95064
Phone: 831-459-3500 Fax: 831-459-3502
Web site: http://www.crede.ucsc.edu

CREDE's mission is to assist the nation's diverse students at risk of educational failure to achieve academic excellence. CREDE's research and development focuses on critical issues in the education of linguistic and cultural minority students and those placed at risk by factors of race, poverty, and geographic location.

Center for the Education of Women
330 East Liberty
Ann Arbor, MI 48104-2289
Phone: 313-998-7240 Fax: 313-998-6203
Orders: 800-956-7739, ext. 756

It is the first comprehensive, university-based women's center of its kind. Research topics of interest include: barriers or enhancements to women's educational achievement, participation and success of girls in science, mathematics, and engineering, and women's leadership. Publishes *The Equity Equation: Women in Science, Mathematics, and Engineering* and *The Equity Agenda.*

Center for the Enhancement of Science and Mathematics Education (CESAME)
Northeastern University
716 Columbus Avenue, Suite 378
Boston, MA 02120
Phone: 617-373-8380 Fax: 617-373-8496
Web site: http://www.dac.neu.edu/cesame/

CESAME aims to create awareness and support the implementation of standards-based curricula by providing high quality professional development in mathematics and

science. Professional development efforts include individual work with teachers and schools, workshops for educators and education leaders, and research on effective models for successful implementation.

Consortium for Educational Equity at Rutgers University
36 Street 1603
Piscataway, NJ 08854-8036
Phone: 732-445-2071

Operates a library with extensive resources on equity in mathematics and science education.

Consortium for Mathematics and its Applications (COMAP)
57 Bedford Street, Suite 210
Lexington, MA 02420
Phone: 1-800-772-6627 Fax: 781-863-1202
Web site: http://www.comap.com

Since 1980, COMAP has worked with teachers, students and business people to create learning environments where mathematics is used to investigate and model real issues in our world. The ARC Center at COMAP promotes the implementation of standards-based elementary mathematics curricula through consultation with schools, information and resources that support teacher enhancement, leadership development, and public awareness of mathematics.

Council of Chief State School Officers (CCSSO)
One Massachusetts Avenue, NW
Suite 700 Æ Washington, DC 20001-1431
Phone: 202-408-5505 Fax: 202-408-8072
Web site: http://www.ccsso.org

The CCSSO is a nationwide, non-profit organization composed of public officials who lead the departments responsible for elementary and secondary education. The CCSSO's Resource Center on Educational Equity provide services designed to ensure equitable, high-quality and developmentally appropriate education for all students, especially minorities, girls, students with disabilities, limited English proficient students, and low-income students.

Developmental Studies Center
2000 Embarcadero, Suite 305
Oakland, CA 94606-5300
Phone: 510-533-0213 Fax: 510-464-3670
Web site: http://www.devstu.org

DSC was formed in 1980 to conduct research and develop school-based programs that foster children's intellectual, ethical, and social development. Their Child Development Project is a comprehensive, long-term collaboration with elementary schools that is helping create caring communities of learners in classrooms and schools. They also offer professional development services and have created Number Power, standards-based elementary mathematics curriculum.

Disabilities Unlimited
3 East 10th Street, Suite 4B
New York, NY 10003
Phone: 212-673-4284 Fax: 212-673-4284

Disabilities Unlimited Consulting Services promotes equal opportunity and empowerment for people with disabilities. Services include consultation and training on federal, state, and local disability rights laws, lectures on disability equity issues for professional organizations, and action-oriented research. A focus on education and gender issues as they relate to disabilities are also part of the organization's mission.

The Education Trust
1725 K Street NW Suite 200
Washington, DC 20006
Phone: 202-293-1217 Fax: 202-293-2605
Web site: http://www.edtrust.org

The Education Trust is a non-profit organization that seeks to make schools and colleges accountable for academic achievement of all students with a focus in low-income, Latino, African American and Native American students. The Education Trust works with policymakers, parents, educators, community and business leaders across the country to implement reform that is all-inclusive. They delineate basic steps for improvement and provide advocacy, analysis, research, reports, and assistance to schools.

Educational Equity Concepts
100 5th Avenue, 2nd Fl.
New York, NY 10011
Phone: 212-725-1803 Fax: 212-725-0947
Web site: http://www.edequity.org

Educational Equity Concepts, Inc. is a national non-profit that promotes bias-free learning through innovative programs and materials. EEC's mission is to decrease discrimination based on gender, race/ethnicity, disability, and income. Activities include hands-on materials and programs for early childhood and elementary classrooms, workshops for educators, research projects, and various publications.

Eisenhower National Clearinghouse for Mathematics and Science Education
1929 Kenny Road
Columbus, OH 43210
Phone: 614-292-3330 Fax: 614-292-2066
Web site: http://www.enc.org

This U.S. Department of Education program offers a wide array of free print and electronic resources related to school reform and educational equity. The ENC web site provides links to hundreds of web sites and other organizations, a searchable database of over 10,000 resources, and examples of successful reform strategies.

EQUALS

Lawrence Hall of Science
University of California
Berkeley, CA 94720-5200
Phone: 510-642-1823 or 800-897-5036 Fax: 510-643-5757
Web site: http://www.lhs.berkeley.edu/equals/EQhomeFrm.htm

Since 1977, EQUALS programs have worked to increase access and equity in mathematics for all students and particularly under-represented groups. EQUALS provides workshops and curriculum materials in mathematics for teachers, parents, and community members. The FAMILY MATH program teaches parents how to help their children with math at home.

Equity Assistance Centers
U.S. Department of Education
400 Maryland Avenue, SW
Washington, D.C. 20202-0498
Phone: 202-260-2666
Web site: http://www.equitycenters.org

This U.S. Department of Education initiative aids schools in promoting gender, racial, and national origin equity. The ten desegregation centers provide training, planning, and other technical assistance to school districts throughout the nation.

Girls Count
225 East Avenue, Suite 475
Denver, CO 80203
Phone: 303-832-6600 Fax: 303-832-7331
Web site: http://www.girlscount.org

Girls Count seeks to expand girls' education and career opportunities by increasing awareness and impacting policies and actions of those who influence girls. Their web site links to a variety of resources for parents and educators. Publications, including *Equity Threads: Serving All Students in School-to-Career Systems*, *Educator In-service on Gender Equity*, and *Through the Equity Lens*, are also available for purchase on-line.

Girls Incorporated
30 East 33rd Street
New York, NY 10016-5394
Phone: 212-683-1253
Web site: http://www.girlsinc.org

Girls Incorporated is a national youth organization dedicated to helping every girl become strong, smart and bold. Operation SMART offers informal, out-of-school programs to sustain girls' interest and participation in science, math, and technology in 35 states across the country.

Girls Start
608 West 22nd Street
Austin, Texas 78705
Phone: 1-877-768-4775 Fax: (512) 916-4776

Web site: http://www.girlstart.org

Girlstart provides a supportive and empowering atmosphere in which girls perform hands-on activities with robots, microscopes, environmental science, math, engineering, and technology. Saturday and Summer Camps are held on-site at the Girls' Tech Center in Austin, TX, for girls ages 10 to 14 (unless otherwise noted in specific program descriptions). Girls learn science, math, engineering, and technology concepts in a fun and energetic environment. The Girlstart website features activities for girls as well as resources for parents.

IDRA
5835 Callaghan Road, Suite 350
San Antonio, Texas 78228-1190
Phone: 210-444-1710 Fax: 210-444-1714
Web site: http://www.idra.org

IDRA is an independent, non-profit organization that advocates the right of every child to a quality education. For more than 20 years, IDRA has worked for excellence and equity in education in Texas and across the United States. IDRA conducts research and development activities; creates, implements and administers innovative education programs; and provides teacher, administrator, and parent training and technical assistance. Their newsletter is free and contains information on current issues is school reform.

K2 Associates, LLC
2 Science Court
Madison, WI 53711
Phone: 608-232-7099 Fax: 608-232-9064
Web site: http://www.k2-associates.com

K2 Associates provides consultation and training for boards, administrators, teachers, and parent organizations around issues of educational equity. K2 Associates works with schools to measure and improve their climate of inclusiveness of all students by surveying students, teachers, administrators, and parents and compiling the results of the surveys, along with observations, policy reviews, and curriculum and program reviews, into a complete site assessment written report. K2 Associates' resource guide *Educating All Our Children* supports this work in an easy-to-use manual for educators.

Math/Science Network
Mills College
5000 MacArthur Boulevard
Oakland, California 94613-1301
Phone: 510-430-2222 Fax: 510-430-2090
Web site: http://www.elstad.com/msn.html

The Math/Science Network is a non-profit membership organization of educators, scientists, mathematicians, parents, community leaders, and government and corporate representatives whose mission is to promote the continuing advancement in mathematics and science education of all people, with a particular emphasis on the needs of women

and girls. Coordinates "Expanding Your Horizons in Science and Mathematics" conferences for girls in grades 6-12.

Mid-Atlantic Eisenhower Consortium for Mathematics and Science Education Research for Better Schools
444 North Third Street
Philadelphia, PA 19123
Phone: 215-574-9300 X280 Fax: 215-574-0133
Web site: http://www2.rbs.org

As one of the ten regional consortia funded by the U.S. Department of Education, this organization operates a web site that includes extensive resources on professional development, currilcula, current math and science news, and research. Focuses primarily on Delaware, District of Columbia, Maryland,, New Jersey, and Pennsylvania.

National Alliance for Partnerships in Equity (NAPE)
505 Bell Road
Christiana, PA 17509
Phone: 717-529-6635 Fax: 717-529-6704
Web site: http://www.napequity.org

NAPE is a consortium of state agencies responsible for career and technical education who have joined forces to provide national leadership for equity in vocation education. NAPE supports and encourages educational policies and programming for you and adult women and men that reduce gender barriers commonly found in the educational system. NAPE's *System-Building Standards for Education Reform* may be of particular use to those looking for ways to assess how equitable their schools and classrooms are.

National Alliance of State Science and Mathematics Coalitions (NASSMC)
11 Dupont Circle, NW, Suite 250
Washington, D.C. 20036
Phone: 202-387-4025 Fax: 202-387-4025
Web site: http://www.nassmc.org

NASSMC s mission is to promote state coalitions as a primary vehicle for advancing systemic and continuous improvement in mathematics, science, and technology education at all levels. These coalitions include individuals from education, policy, business, and public sectors of the community.

National Center for Fair and Open Testing
342 Broadway
Cambridge, MA 02139
Phone: 617-864-4810 Fax: 617-497-2224
Web site: http://www.fairtest.org

The National Center for Fair & Open Testing (FairTest) is an advocacy organization working to end the abuses, misuses and flaws of standardized testing and ensure that evaluation of students and workers is fair, open, and educationally sound. FairTest places special emphasis on eliminating the racial, class, gender, and cultural barriers to equal

opportunity posed by standardized tests, and preventing their damage to the quality of education.

National Center for Improving Student Learning and Achievement in Mathematics and Science
1025 W. Johnson Street, Room 557
Madison, WI 53706
Phone: 608-263-4285 Fax: 608-263-3406
Web site: http://www.wcer.wisc.edu/NCISLA/

The NCISLA provides information relating to mathematics and science such as teacher resources, NCISLA publications, K-12 mathematics and science study results, and research papers.

National Coalition for Equity in Education (NCEE)
Center for Educational Change in Mathematics and Science
University of California, Santa Barbara
Santa Barbara, CA 93106
Phone: 805-893-772 Fax: 805-893-2190
Web site: http://www.math.ucsb.edu/NCEE/

NCEE offers a series of workshops and supports a national network focused on equity in mathematics education. The workshops provide an opportunity for educators to reflect deeply on and discuss issues, policies, and strategies; to plan future actions; and to be supported in their leadership. Also publishes a variety of books and pamphlets related to equity.

National Coalition for Sex Equity in Education
1 Redwood Drive
Clinton, NJ 08809
Phone: 908-735-5045 Fax: 908-735-9674
Web site: http://www.ncsee.org

The NCSEE works with equity specialists and educators on issues surrounding gender equity in education. With a focus on providing advocacy, professional development, and networking, the NCSEE runs a conference each summer that addresses to the professional concerns of its members and offers training related to equity.

National Coalition of Girls' Schools
228 Main Street
Concord, MA 01742
Phone: 978-287-4485 Fax: 978-287-6014
Web site: http://www.ncgs.org

NCGS is a coalition of eighty-four girls' boarding and day, private and public schools dedicated to promoting single-sex education for girls. Several of their publications focus on girls and math/science/technology, including *Math and Science for Girls* and *Girls and Technology Idea Book*. The web site contains teaching strategies, tips for parents, and links to other resources.

National Council of Teachers of Mathematics
1906 Association Drive
Reston, VA 20191-1593
Phone: 703-620-9840 Fax: 703-476-2970
Orders: 800-235-7566
Web site: http://www.nctm.org

The mission of the National Council of Teachers of Mathematics is: to provide the vision and the leadership necessary to improve the learning of mathematics by all students; to promote excellence in the teaching of mathematics by all teachers; and to serve as an advocate for mathematics education. As the largest professional association of mathematics educators in the world, NCTM offers a wide variety of print and other resources for educators. It has developed comprehensive Standards in three areas: curriculum and assessment, teaching practices, and assessment.

National Council of Supervisors of Mathematics
P.O. Box 10667
Golden, CO 80401
Phone: 303-274-5932
Web site: http://forum.swarthmore.edu/ncsm/

NCSM aims to develop and promote designated leadership at all levels of mathematics education. It serves leaders of pre-K through adult mathematics education by offering a Leadership Academy, an annual conference, print resources, a web site with membership information and other links, and publishes the *Journal of Mathematics Education Leadership.*

National Institute for Community Innovations (NICI)
235 Main Street
Montpelier, VT 05602-2410
Phone: 802-223-0463 Fax: 802-229-2013
Web site: http://nici-mc2.org

NICI aims to foster local economic and social well- being through educational innovation, especially in economically distressed communities. The NICI web site contains information on equity in education, including web links, organization initiatives, and on-line forums.

National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230
Phone: 703-306-1234
Web site: http://www.nsf.gov/

The National Science Foundation is an independent U.S. government agency responsible for promoting science and engineering through programs that financially supports almost 20,000 research and education projects in science and engineering. The web site contains a searchable database with extensive publication listings relating to gender and math/science/technology.

National Women's History Project
7738 Bell Road
Windsor, CA 95492-8518
Phone: 707-838-6000 Fax: 707-838-0478
Web site: http://nwhp.org

Established National Women's History Month, serves as a clearinghouse for information on U.S. women's history, and runs a web site with hundreds of links. Also offers books such as *Math Equals a Well-Paying Career* and *Mathematics Can Be Fun.*

Pathways to Equity and Excellence
The College Board
133 20th Street, NW, Suite 600
Washington, D.C. 20036-2304
Phone: 202-822-5930 Fax: 202-822-5939
Web site: http://www.collegeboard.org/sls/equity/html/equity.html

Born out of the lessons learned from the College Board's EQUITY 2000¤ project, Pathways to Equity and Excellence offers professional development for school administrators, school counselors, teachers, parent liaisons/coordinators, data managers and other school personnel which teach and model those concepts/skills and pedagogues which build college going aspirations and foster academic excellence for all.

Regional Educational Laboratory Network
Throughout the United States
Web site: http://www.relnetwork.org

The network of 10 Regional Educational Laboratories, serving geographic regions that span the nation, works to ensure that those involved in educational improvement at the local, state, and regional levels have access to the best available information from research and practice. The members of the network focus on issues such as school reform, educational equity, technology, curriculum, language, and assessment. The groups are: Appalachia Educational Laboratory (AEL), Laboratory for Student Success (LSS), Mid-continent Research for Education and Learning (McREL), LAB at Brown University, Northwest Regional Educational Laboratory (NWREL), North Central Regional Educational Laboratory (NCREL), Pacific Resources for Education and Learning (PREL), SERVE, Southwest Educational Development Laboratory (SEDL), and WestEd.

S.E.E.D. Project on Inclusive Curriculum
Wellesley College Center for Research on Women
Wellesley, MA 02481
Phone: 781-283-2520 Fax: 781-283-2504
Web site: http://www.wellesley.edu/WCW/projects/seed.html

The S.E.E.D. Project, a staff-development equity project for educators, is in its thirteenth year of establishing teacher-led faculty development seminars in public and private schools throughout the United States and in English-speaking international schools. A week-long SEED Summer Leaders' Workshop prepares school teachers to hold year-long

reading groups with other teachers to discuss making school curricula more gender-fair and multi-culturally equitable in all subject areas.

Strengthening Underrepresented Minority Mathematics Achievement (SUMMA)
Mathematical Association of America
1529 18th Street, NW
Washington, D.C. 20036
Phone: 202-319-8474 Fax: 202-483-5450
Web site: http://www.maa.org/summa/archive/summa_wl.htm

The SUMMA Program of the Mathematical Association of America was established in 1990 to increase the representation of minorities in the fields of mathematics, science and engineering and improve the education of minorities.

Summer Math
300 Shattuck Hall
Mount Holyoke College
South Hadley, MA 01075
Phone: 413-538-2069 Fax: 413-538-2002
Web site: http://www.mtholyoke.edu/proj/summermath/

SummerMath aims to help girls strengthen mathematical thinking and communications skills, develop problem solving strategies and computer skills, and build confidence through a month-long summer program for girls in grades 8-11.

Teaching SMART
1920 Plaza Boulevard, P.O. Box 2813
Rapid City, SD 57709
Phone: 1-800-529-1400 Fax: 605-342-0693
Web site: http://www.teachingsmart.org

Teaching SMART, a program of Girls Incorporated of Rapid City (South Dakota), is an equity-based, comprehensive three-year teacher professional development program designed to produce systemic change in the classroom by improving science education at the elementary school level. The mission of Teaching SMART is to encourage the performance and persistence of all students, particularly girls and minority youth, in elementary science.

TERC
2067 Massachusetts Avenue
Cambridge, MA 02140
Phone: 617-547-0430 Fax: 617-349-3535
Web site: http://www.terc.edu

TERC is a nonprofit research and development organization committed to improving mathematics and science learning and teaching. Founded in 1965, TERC is internationally recognized for creating innovative curricula, fostering teacher professional development, pioneering creative uses of technology in education, contributing to educators' understanding of learning and teaching, and developing equitable opportunities for under-served learners. Projects of relevance to math/science/technology and equity

include: Weaving Gender Equity into Math Reform, Through the Glass Wall, Cheche Konnen, Regional Alliance, and Project MEET.

United States Department of Education
400 Maryland Avenue, SW
Washington, D.C. 20202-6140
Phone: 202-260-2666 Fax: 202-205-0302
Web site: http://www.ed.gov/

Publishes a wide variety of documents relating to education. All publications are free and can be ordered through the web site.

Vermont Institute for Science, Mathematics, and Technology (VISMT)
Dillingham Hall
7 West Street
Montpelier, VT 05602
Phone: 802-828-0060
Web site: http://www.vismt.org

VISMT works with Vermont's schools and communities to transform science, mathematics, and technology education in order to improve the learning and the skills of all students. VISMT supports change in a systemic way by working with all constituents who have a stake in education. An important component of VISMT's work is on education equity in the state of Vermont. This effort consists of analysis of data to look for achievement gaps between groups of students, identification and support of regional equity resource people, piloting of the program for Complex Instruction, and participating in Vermont Leadership for Equity, Anti-Racism, and Diversity in Schools.

Women and Mathematics (WAM)
1529 Eighteenth Street, NW
Washington, D.C. 20036
Phone: 202-387-5200
Web site: http://www.mystery.com/WAM/

The Women & Mathematics Network is a consortium of Program Directors of outreach programs in mathematics for women and girls. The W&M network provides: professional development opportunities for program directors; forums for sharing ideas and expertise; and workshops and forums for prospective directors of such programs

Women and Mathematics Education (WME) - SummerMath
50 College Street
Mount Holyoke College
South Hadley, MA 01075-1441
Phone: 413-538-2608 Fax: 413-538-2002

Promotes leadership among women in the broad mathematics community. Serves as a clearinghouse for ideas and resources in the area of women and mathematics. Publishes a newsletter and offers other networking tools. Also provides members with an extensive bibliography/resource list on gender equity in mathematics and technology.

Women in Science and Engineering Programs
University of Michigan
330 E. Liberty
Ann Arbor, MI 48104
Phone: 313-998-7225 Fax: 313-998-6203

Offers information on gender equity issues in science and mathematics education from K-12 through graduate school.

Women's Action Alliance
370 Lexington Avenue, Suite 603
New York, NY 10017
Phone: 212-532-8830 Fax: 212-779-2846

With a focus on encouraging girls in computers, mathematics, and science, the Women's Action Alliance assists educators in creating an equitable technological environment within their schools.

Women's Educational Equity Act (WEEA) Equity Resource Center
55 Chapel Street, D-897
Newton, MA 02158-1060
Phone: 617-969-7100 or 800-225-3088 Fax: 617-332-4318
Web site: http://www.edc.org/WomensEquity/

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. WEEA's catalogue contains numerous print publications on gender equity, including: *Gender-Fair Math*; *Encouraging Girls in Math and Science*; *Teaching Mathematics Effectively and Equitably*; and *Add-Ventures for Girls*.

Equity Workshops

This is a list of workshops on equity located throughout the country. Please contact the workshop organizers directly for information on time, location, and costs.

Connections Across Cultures Project
Jefferson School
1650 W. 22nd Street
Eugene, Oregon 97405
Phone: 541-687-3221, Charlotte Behm and Leece Lee
E-mail: behm@eug4ja.lane.edu or lee_le@eug4ja.lane.edu
Web site: http://www.wvmccd.cc.ca.us/mc/cac/
Workshop location: nationwide and on-line

> The Connections Across Cultures Project (CaC) is built upon the voices of people who are female, American Indian, African American, and Latina/o. These voices have come from more than 200 interviews, 750 articles and books, classroom research, textbook analyses, and other research activities. The project has developed a set of 20 research-based strategies to facilitate the interest, motivation, and achievement of students of various cultures and both genders. The strategies reach not only the small percentage who have "made it" in our technical system, but also the ones whom we are trying to reach, but leave behind. The project offers workshops nationally as well as an on-line course for teachers, educators, and community leaders.

Connections for Learning
P.O. Box 298144
Columbus, Ohio 43229
Phone: 614-475-1503
E-mail: bidwell.14@osu.edu
Workshop location: nationwide

> Connections for Learning provides educators with a range of professional development opportunities related to inquiry-based math and science learning, problem solving, team building, and equity. Links are made between equity and reform math teaching methods. For example, when discussing the value of manipulatives a connection is made to thinking about how such tools can especially help girls who may not have had as much experience with spatial problems. Schools or districts can contact the organization with their specific interests and needs.

EMI (Empowering Multicultural Initiatives)
Lincoln Public Schools
Ballfield Road
Lincoln, MA
Phone: 781-259-2639

E-mail: carroll_blake@lincnet.org
Workshop location: Massachusetts

EMI is non-profit training organization that originated as a collaborative of nine suburban school districts in the Metro West region of Boston, MA. They offer courses to educators on developing and implementing effective anti-racist practices and programs in classrooms and schools. Workshops range from one-hour presentations on diversity to a thirty-seven hour graduate-level seminar on anti-racist teaching, with the option of individual school consultations as well. EMI also works with pre-service teachers and students. A few events they have organized in the past are a conference on affirmative action and an EMI Summer Institute.

Engaging Middle School Girls in Math and Science
WEEA Equity Resource Center
55 Chapel Street
Newton, MA 02458-1060
Web site: http://www.edc.org/WomensEquity
Workshop location: the Internet

This nine-week online course focuses on building classroom environments that support girls' achievement in math and science. The course will look at the social and academic needs of girls at this stage of their development. It also will look at ways to increase girls' interest in math and science and to examine factors that affect their achievement levels. Some of the topics that are covered include: gender in math and science classrooms; equitable expectations and interactions; equitable teaching strategies; and equity in assessment.

EQUALS
Lawrence Hall of Science
University of California
Berkeley, CA 94720
Phone: 510-642-1823
E-mail: equals@maillink.berkeley.edu
Web site: http://www.lhs.berkeley.edu/equals/EQhomeFrm.htm
Workshop location: California and nationwide

EQUALS programs work to increase access and equity in mathematics for all students and particularly under-represented groups. With an attention to gender and race, class and culture EQUALS presents ways of learning and thinking about mathematics that help build access and success for all students. The workshops combine information on inquiry-based mathematics with a perspective on equity. EQUALS programs can be found throughout the United States through a network of sites offering workshops and materials.

EQUITY 2000
The College Board
1233 20th Street, N.W.
Washington, DC 20036-2304
Phone: 202-822-5930
E-mail: equity@collegboard.org
Web site: http://www.collegeboard.org/equity/html/indx001.html

EQUITY 2000 is The College Board's district-wide (K-16) education reform model that promotes educational excellence for all students. The goal is to close the gap in college-going and success rates between minority and non-minority, advantaged and disadvantaged students. EQUITY 2000 offers an Adoption Institute for districts interested in implementing its principles and components. There are also numerous two-day workshops throughout the year designed to deal more students into the educational system by supporting pre-K through 16 reform policies and practices. With offerings in several areas - counseling, mathematics teaching, data management, leadership and "safety nets" - each of the workshops targets a specific area of reform.

Equity Assistance Center
The Metro Center for Urban Education
82 Washington Square East, Suite 72
New York, NY 10003
Phone: 212-998-5100, 1-800-4NYU-224
Web site: http://www.nyu.edu/education/metrocenter/eac/eac.html
Workshop location: New York, New Jersey, Puerto Rico, Virgin Islands

The EAC's mission is to provide school districts and other responsible educational agencies with the technical assistance they need to cope with the special educational problems occasioned by desegregation. They work in the areas of race, gender, and national origin. Some of the services provided in each area of desegregation include staff development programs, turnkey training, needs assessment, identification of resources, long-term strategic planning, consultations, seminars and conferences, materials development, and data analysis.

Failing at Fairness
American University
8608 Carlynn Drive
Bethesda, MD 20817
Dr. David Sadker 301-229-8483, Phyllis Lerner 301-229-3284
E-mail : DSADKER@american.edu, PLearner@aol.com
Workshop location: nationwide

The purpose of this in service training project is to increase both the effectiveness and equity of classroom teaching. The training is based on research studies undertaken in classrooms from grade school through graduate school. The program is designed as a flexible, three day, tiered training experience, a design that reflects the time and resource realities of schools. With a focus on gender equity, this workshop uses video, role playing, peer coaching, and information on current equity issues in education to help educators develop an action plan for their classrooms and schools geared towards eliminating disparities between girls and boys.

GenderWise
SummerMath
Mount Holyoke College
50 College Street
South Hadley, MA 01075-1441
Phone: 413-538-2608
E-mail: summermath@mtholyoke.edu
Web site: http://www.mtholyoke.edu/proj/necuse/summermath/gw.htm
Workshop location: Mt. Holyoke College (MA)

The SummerMath program, located at Mt. Holyoke College, invites girls in grades eight through twelve to come experience in-depth mathematical learning for four weeks during the summer with the intention of increasing girls' confidence and interest in math. As a companion to this program, high school and college teachers, administrators, and program developers can attend the GenderWise program, held during July of each summer. Participants at this conference come together to discuss and experience ways to encourage young women to become more invested and engaged in their mathematics studies.

GESA (Generating Expectations for Student Achievement)
GrayMill
22821 Cove View Street
Canyon Lake, CA 92587
Phone: 909-246-2106
E-mail: info@graymill.com
Web site: http://www.graymill.com
Workshop location: nationwide

Designed to help teachers assess their classroom practices, interactions with students, and curriculum materials, GESA contains five units that are each practiced from two weeks to a month. Each unit contains: (1) an area of disparity (instructional contact; grouping and organization; classroom management/discipline; self-esteem; evaluation of student performance); (2) information on interactions (response opportunities and feedback; wait time and physical closeness; touching and reproof; listening and probing; and higher level questioning and analytical feedback); and (3) curriculum related issues (evaluating

materials for bias; math, science, and technology; multicultural/pluralistic resources; gender/race/ethnic balance in history; and physical activity and sexuality). Training is offered as three-day workshops for leaders, who will then return to their schools or school districts and guide teachers through the GESA program.

Midwest Equity Assistance Center
Kansas State University
College of Education
401 Bluemont Hall
1100 Mid-Campus Drive
Manhattan, KS 66506-5300
Phone: 913-532-6408
E-mail: ronna@ksu.edu
Web Site: http://mdac.educ.ksu.edu/
Workshop location: Kansas, Iowa, Missouri, and Nebraska

The Midwest Equity Assistance Center staff, at the request of public school districts or charter schools in the service region, can provide a variety of services including workshops, seminars, conferences, in-service training, technical assistance, and information dissemination. They tackle equity issues related to leadership skills development of culturally diverse students, increasing participation of girls and minorities in math and science, bilingual education, assessment instruments for LEP student performance, and awareness of diverse teaching and learning styles.

National Coalition for Equity in Education
Center for Educational Change in Mathematics and Science
University of California, Santa Barbara
Santa Barbara, CA 93106
Phone: 805-893-7722
E-mail: dawn@math.ucsb.edu
Web site: http://www.math.ucsb.edu/NCEE
Workshop location: Santa Barbara, CA

Geared towards education leaders as well as teachers, the Equity in Mathematics Education Leadership Institute and the Equity in Education Leadership Institute aim to increase the capacity of school districts and states in addressing inequities within their educational system. The workshops include personal experience panels, discussion groups, presentations by project staff, journal writing, hands-on math activities, and goal setting. Participants increase their understanding of the relationships between equity and mathematics education, the process of educational change, and how institutionalized biases and low expectations affect the success of underrepresented groups in mathematics. Participants attend 16 days per year (four 4-day workshops) for two years in teams of 3-6 people, with on-going support and consultation offered by the CECIMS staff.

Northwest Regional Educational Laboratory Equity Center
101 SW. Main Street, Suite 500
Portland, Oregon 97204
Phone: 503-275-9603
E-mail: eqcenter@nwrel.org
Web Site: http://www.nwrel.org/cnorse/
Workshop location: Northwest Region of the U.S.

The Equity Center is committed to helping public school personnel embrace the key concepts of equity and eliminate bias and discrimination--whether overt or subtle, unconscious or intentional, personal or institutional--in the context of their day-to-day activities. They offer several kinds of equity-related workshops. In the Equity Academy, teachers and administrators from a school district come together for two two-days sessions in a comprehensive equity training program. Participants will then be able to conduct equity training that covers race, gender, and national origin equity issues and civil rights laws in their own or neighboring districts. The Equity Center also offers workshops and training to individual teachers/schools/districts upon request. Some of the topic areas covered include cultural bias, teacher expectations, physical segregation in schools, and multicultural curricula.

Pacific Southwest Regional Technology in Education Consortium
Center for Language Minority Education and Research
California State University, Long Beach
1250 Bellflower Boulevard
Long Beach, CA 90840-2201
Phone: 562-985-5806
E-mail: clmer@csulb.edu
Web site: http://psrtec.clmer.csulb.edu/
Workshop location: Arizona, California, Hawaii, Utah, Colorado, Nevada, New Mexico, Pacific islands

The goal of the PSRTEC workshops is to enhance the use of technology in K-12 teaching and learning with a special focus on underserved populations. Two workshops of particular note are "Technology Access for Diverse Learners" and "Critical Pedagogy: Technology and Equity Issues in Education." The first looks at the importance of equity and access, working with diverse populations, and academic success for all students; the second examines the ways in which instruction supports or challenges the existing social reality. Both workshops relate the questions posed to technology in education. Workshops are one to three days in length.

South Central Collaborative for Equity
Intercultural Development Research Association

5835 Callaghan Road, Suite 350
San Antonio, Texas 78228-1190
Phone: 210-684-8180
E-mail: bscott@idra.org
Web site: http://www.idra.org/scce/DACServ.htm
Workshop location: Texas

The SCCE provides one- and two-day workshops to local education agencies (LEAs) with staff development needs in the areas of race, sex and national origin desegregation issues, supporting existing staff development plans or helping to establish new ones. IDRA professional development is designed to assist people to create educational solutions through innovative, participatory, and hands-on presentations, workshops and technical assistance that promote sustained growth and development.

WestEd
730 Harrison Street
San Francisco CA 94107-1242
Phone: 415-565-3000
Web site: http://www.wested.org
Workshop location: California primarily, also nationwide

WestEd performs the following services: collect and disseminate information on issues and problems occasioned by school desegregation; assist with the preparation, adoption and implementation of school desegregation plans; help identify effective education programs; help reduce racial isolation among students; coordinate desegregation-related activities (e.g., conferences, workshops); and provide technical assistance and training to both educators and parents in their efforts to promote equal educational opportunities for all students. Short- and long-term assistance is provided in a variety of forms, including telephone consultations, on-site visits, staff development training, workshops, institutes, conferences and resource materials.

Equity Tools

Equity in the Classroom Checklist

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

In your classroom do *all* students (male, female, different abilities)	**Yes**	**No**	**Not Sure**
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 on a regular and on-going basis?	❑	❑	❑
2. receive quality and varied feedback (questioning, constructive criticism, etc.)?	❑	❑	❑
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. have a chance to use examples and experiences that draw on their own interests?	❑	❑	❑
7. 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)?	❑	❑	❑
8. have exposure to math problems grounded in real life situations that include opportunities to use their own problem solving strategies (estimation, making predictions, multiple problem-solving methods)?	❑	❑	❑
Do you			
1. analyze your interactions with students to check for biased language and stereotyping?	❑	❑	❑

2.	provide activities to develop those skills, such as spatial and higher order problem-solving skills, that some students (e.g. girls) have traditionally struggled with?	❑	❑	❑
3.	hold high expectations for, and communicate those expectations to, all students?	❑	❑	❑
4.	find ways to engage all students in class discussion, even those who are more quiet or passive?	❑	❑	❑
5.	follow established rules for participation (such as wait time) so that no one students dominates class time and teacher attention?	❑	❑	❑
6.	try to use software and other curriculum materials that are free of harmful gender or other stereotypes?	❑	❑	❑
7.	encourage all students to be confident in their abilities as mathematicians?	❑	❑	❑
8.	encourage all students to pursue math in high school, college, and beyond?	❑	❑	❑
9.	structure problem solving activities so that they are cooperative/collaborative rather than competitive?	❑	❑	❑

Equity and Technology Checklist

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

In your classroom do *all* students (male, female, different abilities).	**Yes**	**No**	**Not Sure**
1. have equal time at the computer?	❑	❑	❑
2. take an equal number of turns at the keyboard when working in pairs or small groups?	❑	❑	❑
3. take equal turns deciding what to enter into the computer when working in pairs or small groups?	❑	❑	❑
4. use the computer for mathematical problem-solving (rather than only for practice with isolated skills, such as number facts)?	❑	❑	❑
5. have opportunities to share their thinking and reasoning about the problems they solve on the computer in small groups/with the class as a whole?	❑	❑	❑

Do you.			
1. set aside a computer (or a specific time at one computer) just for girls?	❑	❑	❑
2. offer girls encouragement and support to try new and challenging software?	❑	❑	❑
3. use computers for mathematical activities that draw on the interests and experience of *all* students?	❑	❑	❑
4. let students know that computers are for everyone - no matter what gender, age, or occupation?	❑	❑	❑
5. try to use software free of harmful gender or other stereotypes?	❑	❑	❑
6. help parents to select software for their children that offers mathematical problem-solving experiences?	❑	❑	❑

7. encourage parents to support their daughter's interest in and knowledge about computers?	❑	❑	❑
8. when possible, invite women who use computers professionally to speak to your class?	❑	❑	❑

Developing an Equity Action Plan

Christina Perez and Hollee Freeman, TERC

This action plan is intended to be used as a tool for assessing equity issues in your mathematics classroom and school. We encourage you to fill it out with your colleagues.

1. Needs assessment:

- What do you currently do to help ensure an equitable classroom?

- What equity issues do you want to work on?

- How will you go about doing this?

2. Working with students and colleagues:

- When you plan your mathematics lessons, workshops, what are you priorities? How will you specifically connect the curriculum to issues of equity?

- How can you work with your colleagues in thinking about issues of equity and mathematics in your school?

3. Supporting the community:

- What can you do to involve families and school leaders in the mathematics that is in place at your school?

- What resources might you need to provide?

4. Measuring Change:

- How will you know when you're promoting equity? How will you monitor and measure this?

- How can you work with your colleagues in measuring change related to equity in your classroom and school?

Equity in Math Cooperative Groups
by Hollee Freeman, TERC

Just as there are buzzwords associated with the standards-based reform movement in literacy, there are also words that have come to be associated with the math reform movement such as "math for all" and "equitable classroom". As a former public school teacher in a large urban city and as a math staff developer who travels around the country, I often work with teachers and school leaders grappling with the issue of "cooperative groups" as a way to equitably distribute mathematics instruction and peer interaction among all students in the class. In fact, many teachers struggle daily with issues around an equitable grouping of students for math instruction while simultaneously fulfilling a need for whole group, direct instruction and individualized instruction.

Many teachers in the standards-based math reform movement have re-thought classroom instruction that is based on every student on the same page at the same time". However, many of us are continually trying to answer the question-what does it really mean to have a math class where each student has access to the materials and thinking required in order to develop higher order thinking skills and mathematical understanding? Cooperative groups are commonly used to address the issue. However, the larger question still remains: what constitutes an equitable grouping of students and what do these groupings offer in terms of the depth of mathematical content in the curriculum, as well as goals for individual students?

In many classrooms, cooperative groups for math simply mean a gender, racial and/or ability balance of students in a small group context working on an activity or problem. There is a good reason for this type of organization. Without specific actions to support students working with each other, some students will choose to work with their peers that are most like them (racially, based on language preferences, gender or even socio-economic characteristics). Teachers want all students to have the same chance in math class and to work with a diverse group of their peers. Nevertheless, grouping students in this way may seem to promote educational parity but it often does not. This notion of equity as "same treatment for everyone" is problematic for all students. It often is not based on the mathematical task at hand and creates a chasm between students irrespective of their math interests, language experience and mathematical understanding. Grouping students based on notions of equity can, at times, "inhibit" the math thinking of some group members while perpetuating the low math self-esteem of others. For example, students in my third grade class were working on a multiplication problem:

> Two friends Melissa and Margaret were starting a daycare business so they thought they would put flyers on cars in a huge parking lot at a toy store. It was getting late but they knew that lampposts were positioned at every tenth row. They also knew that there were 19 cars in each row because the rows were completely filled. By the time they stopped, Melissa and Margaret had put flyers on every car up to the sixth lamppost. How many flyers did they use? (one flyer per car)

When I arranged cooperative groups in which students were grouped solely based on language ability or mathematical understanding the students did not benefit as much as students that

were grouped based on more similar strategies or investment in the problem. For example, when fluent English speakers were forced to work with students beginning to learn English or groups in which students who needed to use unifix cubes or draw pictures were immediately paired with students who mentally were able to solve this problem and develop extensions, all students were not able to work up to their potential. In the spirit of community, students were more than willing to slow down their thinking or clarify their statements while other students were working hard to understand strategies and language unfamiliar to them. However, in the limited math time, all students would have been better served in groups based on mathematical content and strategies first and then asked to work together in more heterogeous groups to share their thinking.

I am not suggesting that cooperative groups should be consistently homogeneous based on experience, confidence and skills. However, as with book groups in a classroom literacy context, I am suggesting that math cooperative 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 in order to work in increasingly more complex ways rather than simply being assigned to a group based on their gender, linguistic abilities, or ethnicity.

This notion of looking at the mathematical content of each lesson presupposes that teachers deeply understand the spectrum of mathematics in each strand and are keenly aware of a multitude of strategies from the least to most efficient. Cooperative groups based on mathematical content also presuppose that teachers are adept at questioning; pushing students to search for connections, patterns and meaning in mathematics. Math work times must be flexible in order to allow students to pursue their hypotheses and share their work with the entire class while meeting the individual and group goals that the teacher has developed.

During a recent mathematics lesson in a sixth grade class at a public school in an urban setting, I asked students to solve a 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?

Students began working as I walked around the room asking questions to help students clarify their thinking or to "jump start" them. In this classroom of six girls (less than a fourth of the class), many did not know how to begin. Two boys very quickly calculated their answers using their own invented strategies and the majority of the class rounded numbers, skip counted, used their knowledge of multiplying by 200 and were stuck trying to figure out what to do with the remainder.

I decided to gather the two students together who were separately working on how closely they could calculate the exact time that the crew would run out of biscuits. These students were extremely motivated to answer this (their own question) and worked diligently, talking with each other and making connections that were extremely complex. Other students were not interested in this question or did not even recognize it as a possible extension for the problem.

For most students, this extension seemed disconnected to the math problem at hand. There would have been no point in forcing students to work in a group with this wide degree of interest and mathematical thinking.

I continued to support the other students in the class, particularly the group of girls that did not know how to start. I asked them to work together in order to come up with ideas about how to proceed. Indeed there were boys in the class that were also talking about how to begin working on the problem. However, the fact that this group consisted of all girls did not seem as important at this particular moment compared to the goal of helping them to understand the context of this lesson and to develop strategies for proceeding.

As all students in this class became increasingly more satisfied with their work, they were asked to share their strategies with their peers who had solved the problem in different ways. During this time, I was careful to encourage students to work in heterogeneous groups. This type of group work and sharing of ideas is different than a preconceived organizational system based on outside parameters of gender, ethnicity, etc. rather than mathematical content.

In thinking about conceptions of equity particularly within cooperative groups, it became clear to me that to have chosen students to work on the very specific questions that were a driving force for some students simply to employ the notion of same treatment for everyone would have been a disservice for all of the students involved. This is not to say that students with varying interests, ability levels or mathematical confidence should not share their strategies, frustrations and solutions together. However, just as students need numerous opportunities to work within these diverse groups, they also need time to work within groups where the mathematical content is the driving force. For teachers, it's our job to make sure that we have classrooms that focus on the mathematical content and that when doing so, our cooperative groups are diverse and therefore, mathematically equitable.

Many researchers have differing opinions about the effectiveness of cooperative groups and the variety of ways in which to organize them. In looking at your own classroom, what are some of the issues that resonate when thinking about cooperative groups? How do you organize such groups? Upon what is the grouping based and how does it benefit or interfere with the mathematical thinking and understanding of students? How does the mathematical content of the lesson or activity influence the way in which students work together?

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http://www.lab.brown.edu/investigations/spotlight/archive/equityinmath.html

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Equity in Standards-based Elementary Mathematics Classrooms
by Christina Perez, TERC

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.* Embedded in this idea is the goal of eliminating the long-standing disparities in mathematics achievement between girls and boys, between White students and students of color, and between the economically disadvantaged and the advantaged. 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). Eleven years later, the concerns laid out in the *Standards* still remain a pressing issue for American schools.

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 twelve, 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 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 SAT-Math test 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 a somewhat higher - 35 percent (Campbell and Clewell, 1999). That same year, Blacks and Hispanics (at 22 percent of the total U.S. population) only earned a total of 12 percent of all bachelor's degrees in science, mathematics, and engineering (National Science Foundation, 1999).

Stereotypes begin in the primary grades
As early as 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 succeed in math because they try hard. The first three patterns also hold true for teachers' interactions with White and non-White students (Grayson and Martin, 1997).

Solutions in the standards-based classroom

Standards-based curricula include several teaching methodologies and mathematical content strands not typically found in traditional elementary math classrooms. Students frequently work in cooperative 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. The teacher's role shifts from one who gives information to a more facilitative approach. Communication of mathematical concepts through multiple avenues (drawing, graphs, journals, dialoguing with peers, etc.) is integral. Conceptual understanding, rather than focusing on math facts, is valued.

Many of these changes reflect the 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 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.

Cooperative Groups

In theory, cooperative groups promote 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 non-threatening 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 cooperative 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 cooperative 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, and so on) are directed toward boys (Webb, 1984). 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.

At times placing students of various ability levels together is most appropriate. Students who understand a mathematics problem can help others who may be struggling while simultaneously verifying 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. Though 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, then they may be locked out of higher levels of learning. Here are a few ways to address this disparity:

- 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?
- Stretch students' thinking by asking them to show multiple ways to solve a problem.
- 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.
- 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 of 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 OK to take chances, make mistakes, and succeed in math, 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 cooperative groups and attention to students' problem solving strategies provide two ways to delve deeper into classroom practice in order to ensure an equitable learning environment.

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High-Stakes Does Not Mean High Standards
by Christina Perez, TERC

> "Our children are tested to an extent that is unprecedented in our history and unparalleled anywhere else in the world The result is that most of today's discourse about education has been reduced to a crude series of monosyllables: 'Test scores are too low. Make them go up.'"
>
> - Alfie Kohn, *The Case Against Standardized Testing*[1]

Popular discourse surrounding education reform frequently (mis)equates "standards" with "standards-based instruction." Under the guise that school improvement will come about through the implementation of a rigorous curriculum, many supporters of "high standards" rely on standardized testing as the silver bullet with which to close the achievement gap. This "leave no child behind" lingo would seem to cater to notions of fairness and equity, arguing that all students should have access to high-quality instruction. Yet in practice, it often leaves many children behind and falls short of the kind of true reform that's part of the kind of "standards-based instruction" promoted by the Investigations curriculum.

The history of standardized testing in the United States is an important aspect of this debate, as it points to the original intentions of testing children and helps explain some of the current racial, gender, and class disparities in test scores. The first standardized tests given in the United States came about during the early part of the twentieth century. Lewis Terman, an educator at Stanford University and the principle designer of the Stanford-Binet intelligence test, advocated for the use of IQ testing as a way to track students.[2] By the mid-1920s he had convinced many school districts to use high-stakes tests to sort out the "inferior" students for special education and to identify "superior" individuals for "gifted" programs. Underlying the tests was a belief Terman held that people from certain racial backgrounds, namely Native Americans, Mexican Americans, and African Americans, were intellectually inferior due to their genetic code. Many of these ideas were revisited more than 70 years later with the publication of Charles Murray and Richard Herrnstein's book *The Bell Curve*.

The original purpose for administering standardized tests - to sort students according to perceived ability level - still happens today. Students are tested and then placed into different "tracks," or held back a grade, or put into an accelerated program, or kept from graduating, and so on. Many of these "high-stakes" uses for testing have substantial consequences for the elementary classroom, such as:

- less time is spent on the curriculum and more time spent teaching to the test
- monetary rewards/penalties given to teachers and schools based on test results
- more time is devoted to computation instead of problem solving skills
- students are taught only the math content that is on the test(s)
- students are discouraged from inventing their own strategies and are only taught the standard
- algorithm, since invented strategies may not be as "efficient" (this is of particular concern for timed tests)

- money is directed to testing efforts instead of good curriculum materials
- government threatens to shut down schools that don't perform well on the state exam
- students of color and low-income students disproportionately fail many state tests, and therefore are not allowed to graduate or are retained

The impact of high-stakes testing on lower-income communities and students of color is particularly devastating. On exams such as Massachusetts' MCAS, Florida's FCAT, and Texas' TAAS (all of which have graduation requirements in place), students of color and low-income individuals have failed the tests at high rates and will consequently lose out on earning a high school diploma. Even if a student is "just" retained for not passing the exam, the results can be serious - a strong correlation exists between being retained for one or more years and later dropping out of school. Such practices exacerbate existing educational inequities, and fail to substantively improve teaching and learning.

Data from Texas illustrates this point. Texas' accountability exam TAAS (now termed TAKS) has been a requirement for graduation since 1992-93. In 1998, 70% of all students passed the grade 10 TAAS exam. When that number is broken down by racial groups, we see that 85% of White students, but only 55% of Blacks and 59% of Latinos passed the exam. The dropout rate for Black and Latino students also increased significantly since the implementation of the graduation requirement for TAAS.[3] Just 50% of minority students and 70% of Whites in Texas have been progressing from grade 9 to high school graduation since the initiation of the TAAS testing program. In other words, the use of this high-stakes test has created deep educational divides between students who receive a high school diploma and those who don't.

Despite the serious equity issues present with many state and national assessments, students will continue to be required to take the tests and teachers will be required to administer them. This reality means that teachers using Investigations, or any standards-based mathematics curriculum, must grapple with balancing implementation of the curriculum and preparing students for standardized tests.

The good news is research has demonstrated that the best way to help students prepare for standardized tests is to fully implement a reform math curriculum. A comprehensive study of students in Chicago Public Schools conducted by the Consortium on Chicago School Research supports this claim.[4] The scores on the Iowa Test of Basic Skills (a timed, multiple-choice exam of basic skills) of 110,000 students in grades 2-8 were compared from 1996 to 1997. In schools where teachers used interactive instruction* frequently, students learned 5.1% more than the city average in mathematics. However, in schools where interactive methods were used less frequently, students learned 4.5% less in mathematics. Although the one-year advantage may seem small, the effect can accumulate - over the eight elementary school grades the effect in mathematics amounts to more than half of an additional year of learning.

The findings from the Chicago research are particularly important for teachers using a reform mathematics curriculum. All too often educators get the message that they must put aside the "regular" curriculum and each to the test in order to maximize student scores. Yet the Chicago research shows the positive value in continuing to use an inquiry-based curriculum - even on standardized tests of basic skills.

A second piece of this assessment puzzle is a recognition that one size doesn't fit all when it comes to test preparation - some students need more support while others don't need as much. Different students also need support in different areas and with various types of questions. In much the same way a teacher has to individualize classroom instruction based on varying student needs, it may also be useful to consider individualizing ways to help students prepare for standardized tests. Several questions can help guide this process:

- What are the ways the curriculum already helps students solve this problem? What are some of the gaps you may need to fill in?
- Is the format of the math problem similar to or different from what students are used to seeing? If it's different, then what are some of the things you can do in your classroom to familiarize students with the format?
- Is there any math vocabulary that some or all students won't be familiar with?
- Are there any cultural assumptions/biases built into a particular mathematics problem? How can you help your students deal with contexts that may be new to them?
- What role do speed and efficiency play in solving a particular problem?

Improving education for all students is not something that will happen through the current testing regime, which may seem politically expedient and cost-effective compared with other options but which too often maintains - and, in fact, perpetuates - an inequitable educational system. Educators, parents, and others concerned about high-stakes testing can become involved in their communities. To learn more about local efforts and to find out how to get involved, visit the Assessment Reform Network website at http://www.fairtest.org/arn/arn.htm.

A start, but by no means an end, to achieving high standards for all children will involve: offering effective professional development for teachers; eliminating tracking practices; implementing a rigorous curriculum that encourages problem solving, critical thinking, and in-depth learning; redistributing economic resources to schools most in need; shrinking class size; and ensuring that all students have access to higher education. Such reforms offer authentic steps towards the goal of "leaving no child behind", and will best be supported by full implementation of curricula such as Investigations, which advocates for high standards for all students, and by the elimination - and not the perpetuation - of high-stakes testing.

* Note: Interactive instruction was characterized by: teachers coaching and posing questions that ask for explanation and may have multiple answers; and students discussing answers with their peers and the teacher, and applying and interpreting knowledge into prior understanding.

This article was based in part on the leader guide to "Measuring Student Achievement: The Impact of Standardized Testing on Equity and Excellence in Mathematics", available at http://www.terc.edu/wge/testingsession.html

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